Heating Piping & Air Conditioning

OCTOBER 1955

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INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

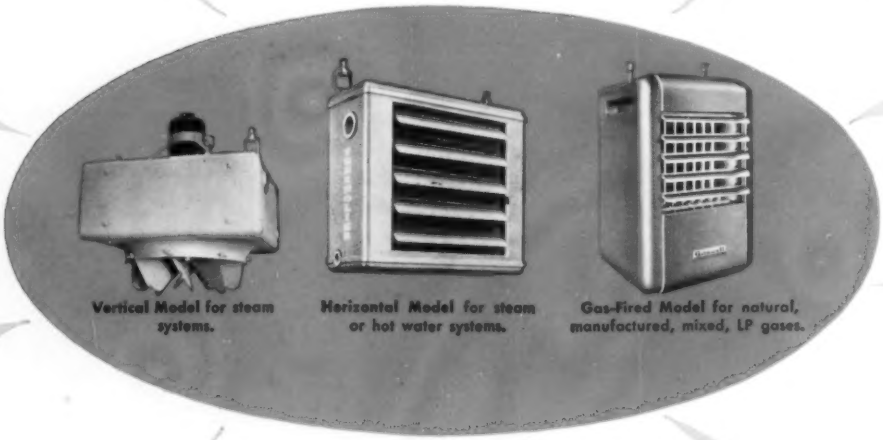
Journal Section of the American Society of Heating and Air-Conditioning Engineers—p. 117

Hot water panels heat new hangars at Chicago's O'Hare field (photo) and at Trans-Canada's Malton, Ont., terminal 82

GRINNELL UNIT HEATERS

...for MAXIMUM comfort, economy, and flexibility

Grinnell Unit Heaters bring you many unique design and construction features, coupled with important advantages in comfort, economy, and ease of heating. Heat comes fast, even from a cold start — and is spread uniformly to all parts of the working area. It is not allowed to bank up uselessly under the ceiling. Units are compact. And, both unit and the simple piping are overhead, out of the way, easy to relocate if necessary. Heating capacity often exceeds that of other types costing twice as much.



Vertical Model for steam systems.

Horizontal Model for steam or hot water systems.

Gas-Fired Model for natural, manufactured, mixed, LP gases.

GRINNELL THERMOLIER
Steam/Hot Water Unit Heater
4 models . . . 18 sizes — from 35,600 to 275,300 total heat delivered, Btu per hour

Three basic models—horizontal, vertical, and a special horizontal Textile model. (Adjustable velocity nozzle also available for use on horizontal models.) All models have plain thermostatic trap, the simplest and least expensive kind of a trap, made practical because of unit's exclusive internal cooling leg; maximum capacity provided and destructive water hammer eliminated by built-in pitch of tubes. Many other important features.

GRINNELL
Gas-Fired Unit Heater
Available in 7 sizes — ranging from 25,000 to 200,000 Btu per hour input

Grinnell Gas-Fired Unit Heaters are easy to install, simple to operate and maintain. Efficient performance is assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit. Automatic safety pilot operates to shut off main gas supply if pilot goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. American Gas Association approved.

Grinnell Unit Heaters are backed by over 60 years of heating experience, and proved by trouble-free service in countless installations. They are distributed by a coast-to-coast network of plumbing and heating jobbers . . . and in over 30 principal cities, Grinnell engineers can offer on-the-spot advice and help on your heating problems. For new buildings, or for modernizing existing heating systems, it makes good sense to call on Grinnell first — for the unit heater that will meet your specific needs.

AVAILABLE FROM YOUR LOCAL DISTRIBUTOR.

Grinnell Company, Inc., Providence, Rhode Island

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

outside installation

usAIRco "packaged" central station air conditioners save floor space, ductwork and labor costs

Central station air conditioner of St. Francisco di Paola Church is concealed by extension of front wall of building, shown by dotted line.

usAIRco's outdoor locations of equipment have proved the answer to cooling existing buildings when lack of space prohibits the usual type of air conditioning installation.

To air condition the Church of St. Francisco di Paola, a religious landmark of San Antonio, Texas, conserve space and preserve the architectural beauty of the church, inside and out, A. H. Thomas, engineer for G. H. Dillard Company, recommended placement of a 20 h.p. usAIRco packaged central station unit (RK) outside the building. The unit was shielded from view by construction of a matching extension to the brick front of the church. The supply duct leads through the outside wall and is concealed in the wall-like railing of the organ and choir loft located at the rear of the church. Five discharge grilles in the choir loft railing deliver the conditioned air at a low velocity, providing quiet, draftless cooling throughout the church. To allow for return of air, two stained glass windows, adjacent to the exterior location of the unit, were removed and replaced with return grilles.

Five discharge grilles at rear of church and two large return grilles are the only visible signs of air conditioning inside the building.

Business needs demanded that the Big Apple Super Market of College Park, Georgia install an air conditioning system. Lack of floor space was the major obstacle. To overcome it, a usAIRco 20 h.p Model RK was installed outside at the rear of the store. The built-in evaporative condenser saves 95% in water consumption by continuous recirculation.

Front view of Big Apple Super Market, air conditioned by usAIRco RK unit.

RK is installed at rear of store, with ductwork leading into store through rear wall.

usAIRco
30 YEARS OF AIR CONDITIONING

For detailed information on usAIRco RK's, write R. H. McLain

UNITED STATES AIR CONDITIONING CORPORATION

MINNEAPOLIS 14, MINNESOTA *Export: 13 E. 40th St., N.Y. 16, N.Y., U.S.A.*

BOSTON PUBLIC LIBRARY
Erected 1888
Wrought iron used for all heating system services throughout the building

HOTEL TOURAINE
Erected 1896
Wrought iron installed in small drainage lines; entire heating system

SHERATON PLAZA
Erected 1912
Wrought iron in fire lines, soil, waste, vent lines under 8"; steam supply, return; refrigeration, brine lines

HUNTINGTON AVE. Y.M.C.A.
Erected 1912
Wrought iron used for all heating system services throughout the building

U. S. CUSTOMS HOUSE
Erected 1900—Addition 1914
Wrought iron used in addition for hot and cold water risers, soil, waste, vent and leader lines

CHAMBER OF COMMERCE BLDG.
Erected 1924
Wrought iron installed in small drainage lines; entire heating system

YEARS SERVICE LIFE TO DATE

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A performance page from BOSTON . . . more proof of the durability of WROUGHT IRON PIPE

Responsible for the increasing use of wrought iron pipe in modern building programs is the growing practice among architects and engineers to take a look into the past for their guide to today's material selection. Typical of the support they find for wrought iron is illustrated by these Boston buildings. Here's proof of longer life, at lower cost per year. Write for our bulletin, *Piping for Permanence.*

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WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 27 No. 10

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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How a Contractor Can Cut Costs By Using Armstrong Steam Traps

● There is more than meets the eye in steam traps. If you don't regularly specify Armstrongs, you ought to know about these cost factors:

1. First Cost. The size and, hence, price of a trap is determined by its capacity. The high capacity of each Armstrong trap often enables you to select a size smaller than you would otherwise use.

2. Installation Cost.

Connections. Armstrong offers you a choice of straight-through horizontal or vertical connections, as well as a right angle trap, to save fittings and labor.

Strainers—seldom needed because ordinary dirt and scale won't plug up an Armstrong. When strainers are desirable, Armstrong offers built-in strainer traps that cost less to buy and install than separate traps and strainers.

Check Valves. Here again, Armstrong offers a cost saving with a stainless steel, spring loaded internal check valve that is superior to external check valves.

3. Call-Back Cost. When you put in Armstrong traps, the job is done. The traps will work without attention, not just for a month or two or even a year, but *more commonly 3 or 4 or 5 years!* No traps have so enviable a record for low maintenance as Armstrongs because the mechanisms in low pressure traps are identical in design, workmanship and materials to those used in traps for 900 lbs. pressure, 900°F temperature.

Get the figures and the facts. Call your local factory-trained Armstrong Representative or write:

ARMSTRONG MACHINE WORKS
874 MAPLE ST., THREE RIVERS, MICHIGAN

How to Select and Install Steam Traps for Lowest Cost:

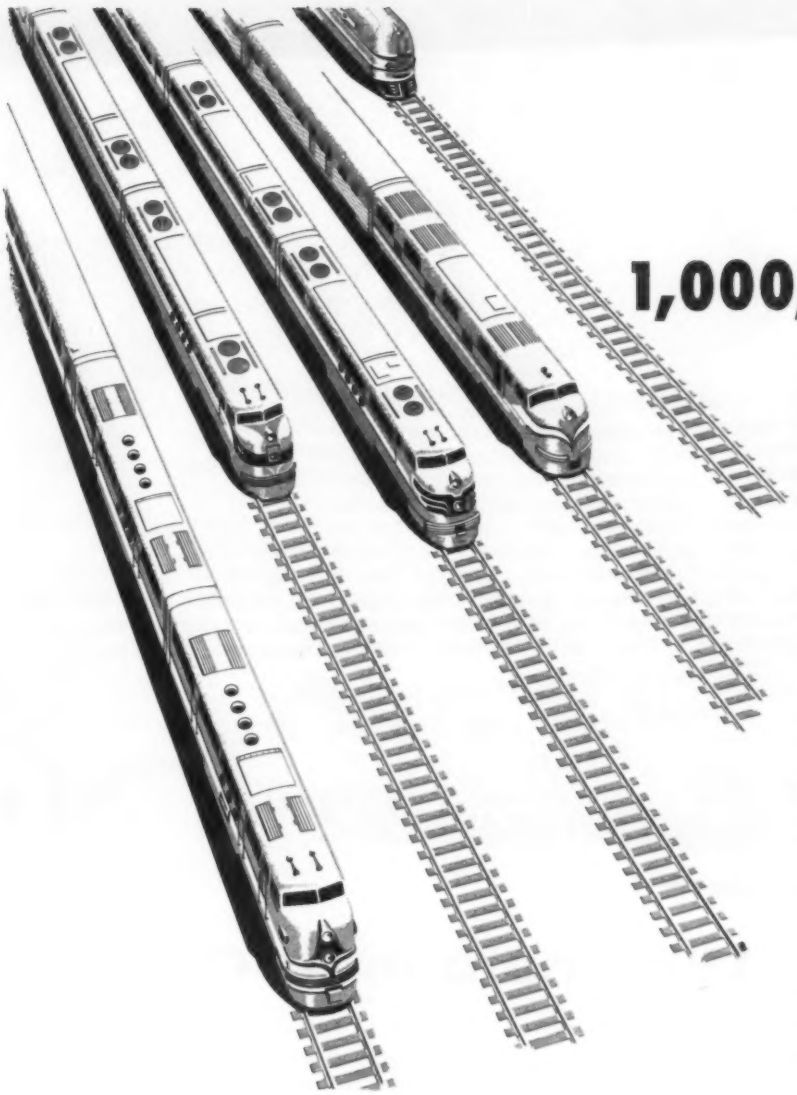
Here are two pieces of useful literature you should have—free on request:

1. Armstrong Steam Trap Book—44 pages of trap data, tables, hookup diagrams and selection information.

2. Unit Heater Trapping—trap selection and installation plus BTU output tables for every model of 30 makes of unit heaters.

UNCONDITIONALLY GUARANTEED TO SATISFY THE USER — APPLICATION ENGINEERED

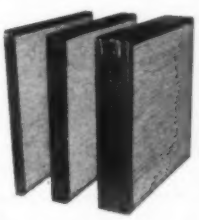
ARMSTRONG STEAM TRAPS



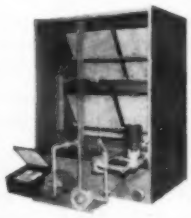
OVER 1,000,000,000 MILES OF TESTING

For many years, FAR-AIR® filters have been standard equipment on the country's leading railroads. They have earned this preference because of their proven ability to operate with uniformly high efficiency under every possible climatic condition. This toughest of all tests is watched critically by businessmen who not only demand top efficiency but economy as well. The fact that FAR-AIR filters have consistently come through with flying colors on both counts is your best assurance of satisfaction when this same equipment is used to solve your air filtration problems.

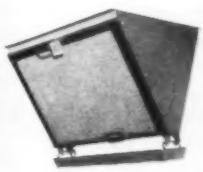
If you, too, look for reasonable first cost, low maintenance cost and high efficiency regardless of conditions, type of job or geographic location, you can depend on FAR-AIR. Write for complete catalog to FARR COMPANY, P. O. Box 45187, Airport Station, Los Angeles 45, California.



Heart of the FAR-AIR line is the 1", 2" and 4" thick filters. Available in all sizes and most metals.



Another FAR-AIR first. A completely automatic filter that washes and re-oils itself. Sizes to meet any CFM requirement.



A complete line of grease eliminators, easy to clean, safe to use, low in cost.

TYPICAL FAR-AIR PRODUCTS

ORIGINATORS OF FAR-AIR CERTIFIED FILTER SERVICE

FARR COMPANY

NO COMPROMISE ON QUALITY

Los Angeles, New York, Chicago

New Orleans

MANUFACTURED UNDER LICENSE BY FARR COMPANY MANUFACTURING LTD. MONTREAL, CANADA

New Dimensions in Comfort . .

Only one standard—*perfection*—guided the creators of this magnificent luxury resort. Here is comfort on a scale rarely experienced and never to be forgotten.

Emphasizing the enjoyment of The Fontainebleau's matchless splendor is a made-to-order indoor climate that's better than Nature's best! Ideal, perfectly regulated temperatures are constantly maintained throughout the entire building by a specially designed system of Johnson Automatic Temperature Control.

Highlights of this pace-setting control system include finger-tip selection of temperatures through Johnson Thermostats in each of The Fontainebleau's 565 guest rooms, all of which are equipped with Johnson-controlled air conditioning units.

The comfort requirements of the public areas are met with equal satisfaction by other Johnson thermostats, valves and related apparatus controlling 22 York "Recold" air conditioning units, ranging from 4.86 to 118.4 tons. These spaces vary in size from small shops to large dining rooms, cocktail lounges, the 17,000 sq. ft. Main Lobby and a Grand Ballroom accommodating 1,800 people.

With this Johnson-engineered Control System, The Fontainebleau enjoys not only the benefits of the finest in modern comfort control, but also is assured of the maximum return on every heating and cooling dollar spent.

The fact that The Fontainebleau—and the great majority of the nation's other better buildings—depend on Johnson Control is your assurance of its unmatched superiority. Johnson can provide the same high standards of comfort and economy for *any* building, small or large. An engineer from a nearby Johnson branch will gladly discuss your temperature control problems and give you his recommendations without obligation.

Johnson Service Company, 507-B East Michigan Street, Milwaukee 1, Wisconsin. Direct Branch Offices in Principal Cities.

Hotel Fontainebleau, Miami Beach. Morris Lapidus, architect, New York and Miami Beach; Sasnett & Bennett, mechanical engineers, Miami; B. A. Jacobi, air conditioning engineering advisor, New York; Taylor Construction Co., general contractor, Miami; Hill York Corp., air conditioning contractor, Miami.

JOHNSON CONTROL

TEMPERATURE AIR CONDITIONING

PLANNING • MANUFACTURING • INSTALLING • SINCE 1885

For America's Finest Luxury Hotel . . .
Indoor Climate that's Better than Nature's Best!

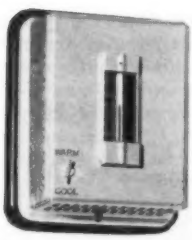
Spacious size presents no comfort problem in The Fontainebleau's impressive lobby or other public areas. Strategically located Johnson Thermostats insure refreshing, even temperatures regardless of the outdoor weather.

Johnson *Individual Room* Control allows the occupants of each room to select their own personal weather. Thermostats regulate the supply of conditioned air furnished by units mounted above the entrances.

In La Ronde, the hotel's smart supper club, as many as 500 guests are entertained in perfect comfort. Johnson Thermostats easily compensate for changing occupancy levels to maintain an ideal temperature.

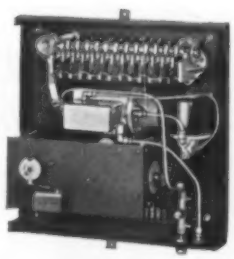
. . the Fabulous Fontainebleau

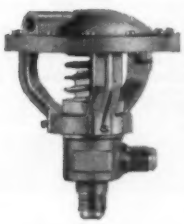
Interesting Applications of JOHNSON CONTROL . . .



Room temperatures to suit the individual preference of guests are provided through Johnson T-432 Heating-Cooling Thermostats controlling Johnson Water Valves on room units. This sensitive, fast-acting thermostat permits occupants to enjoy ideal temperatures at all times—never feel a need for more or less heating and cooling. For complete description of operating features, write for Bulletin T-432.

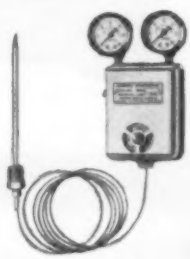
Capacity control of the Fontainebleau's seven refrigeration compressors is accomplished automatically by a Johnson Pneumatic Step Controller. The unit starts compressors in proper sequence to maintain the set chilled water temperature. A time delay assures the proper interval between successive switch operations on start-up or after current failure. Send for Bulletin G-180.





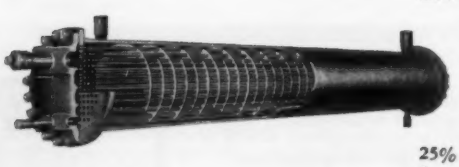
Air conditioning units in guest rooms are equipped with Johnson V-152 Water Valves to regulate the hot and chilled water supply. Designed especially for this type of application, this compact valve provides smooth, accurate response to the demands of the Room Thermostat. Features include V-ring self-sealing packing and molded rubber diaphragm. Write for Bulletin V-152.

Comfort control in some of the public areas is provided by the highly accurate Series T-800 Johnson Thermostats which sense the temperatures of the return air and maintain the temperature of the conditioned air at the proper level. Series T-800 Thermostats are available in a variety of models and are adaptable to many applications. Send for Bulletin T-800.



This STAR FEATURE of the new gives you a SMALLER, LIGHTER, MORE EFFICIENT

25% more cooling capacity per cubic foot



After years of research and testing, Acme announces a new and important advancement — the first real innovation in direct expansion liquid chiller design since Acme's introduction of the original Dry-Ex in 1937. A new copper tubing with a star-shaped aluminum insert* more than doubles the effective heat transfer surfaces between water and refrigerant. This makes the new Dry-Ex the first liquid chiller designed specifically for today's refrigerants. Combined with all the proved advantages of Acme's thru-tube construction, the star-insert tubing makes the new Dry-Ex smaller and lighter, with 25% more cooling capacity per cubic foot than ever before possible.

Acme's new aluminum insert provides clear passages for the flow of refrigerant so that the pressure drop is minimized. Imbedded in the walls of the tubes by a cold-drawing process, the aluminum establishes molecular contact with the copper for perfect heat conductivity.

Whether it's an air conditioning or a process chilling application, the new Dry-Ex will allow you to build a more compact system — one that is economical to install and operate. Dependability is assured. The new Dry-Ex incorporates all the proven construction features that have made the Dry-Ex the leading product in its field since originated by Acme in 1937.

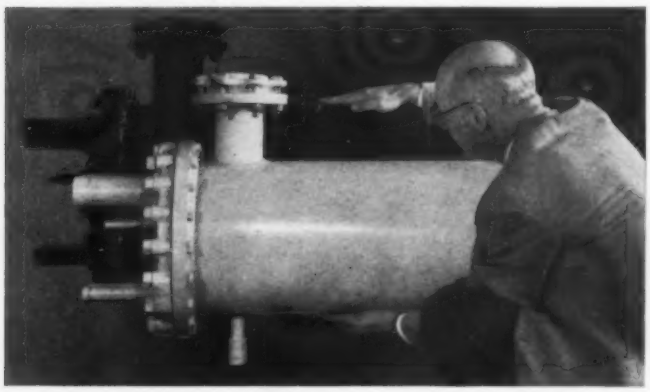
* Patent applied for.

ACME INDUSTRIES, INC. JACKSON, MICHIGAN

Acme DRY-EX® LIQUID CHILLER

PROVEN THRU-TUBE EFFICIENCY MAINTAINED

Acme's star-shaped aluminum insert tubes of the new Dry-Ex extend straight through to multi-pass heads at each end. No bends, no soldered joints — no leaks! High refrigerant velocity is maintained and controlled to achieve greater chiller efficiency, lower pressure drop and more positive oil return than is possible with any other construction.



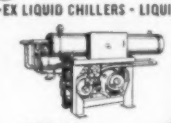
CHILLER SIZE AND WEIGHT REDUCED SIGNIFICANTLY

Diagram shows typical reduction in chiller diameter made possible by the greater heat-transfer capacity of Acme's new Dry-Ex. Because of their smaller size, these chillers fit into closer spaces, are easier for the contractor to handle and install. Reduced weight saves freight costs and smaller cubic content of refrigerant and water means a smaller refrigerant charge, less load on floors and mounting structures.

NEW DRY-EX CATALOG is packed with useful information, contains new selection procedures to simplify your engineering.

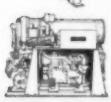
SEND COUPON BELOW TODAY

DRY-EX LIQUID CHILLERS · LIQUID RECEIVERS · HEAT EXCHANGERS · CONDENSERS



PACKAGED CHILLERS

EVAPORATIVE CONDENSERS AND COOLING TOWERS



PACKAGED HEAT PUMPS

ACME AIR CONDITIONING REFRIGERATION

CONVECTORS

ACME INDUSTRIES, INC.

Jackson, Michigan

Send me the complete new catalog on Dry-Ex liquid chillers.

Name..... Title.....

Address.....

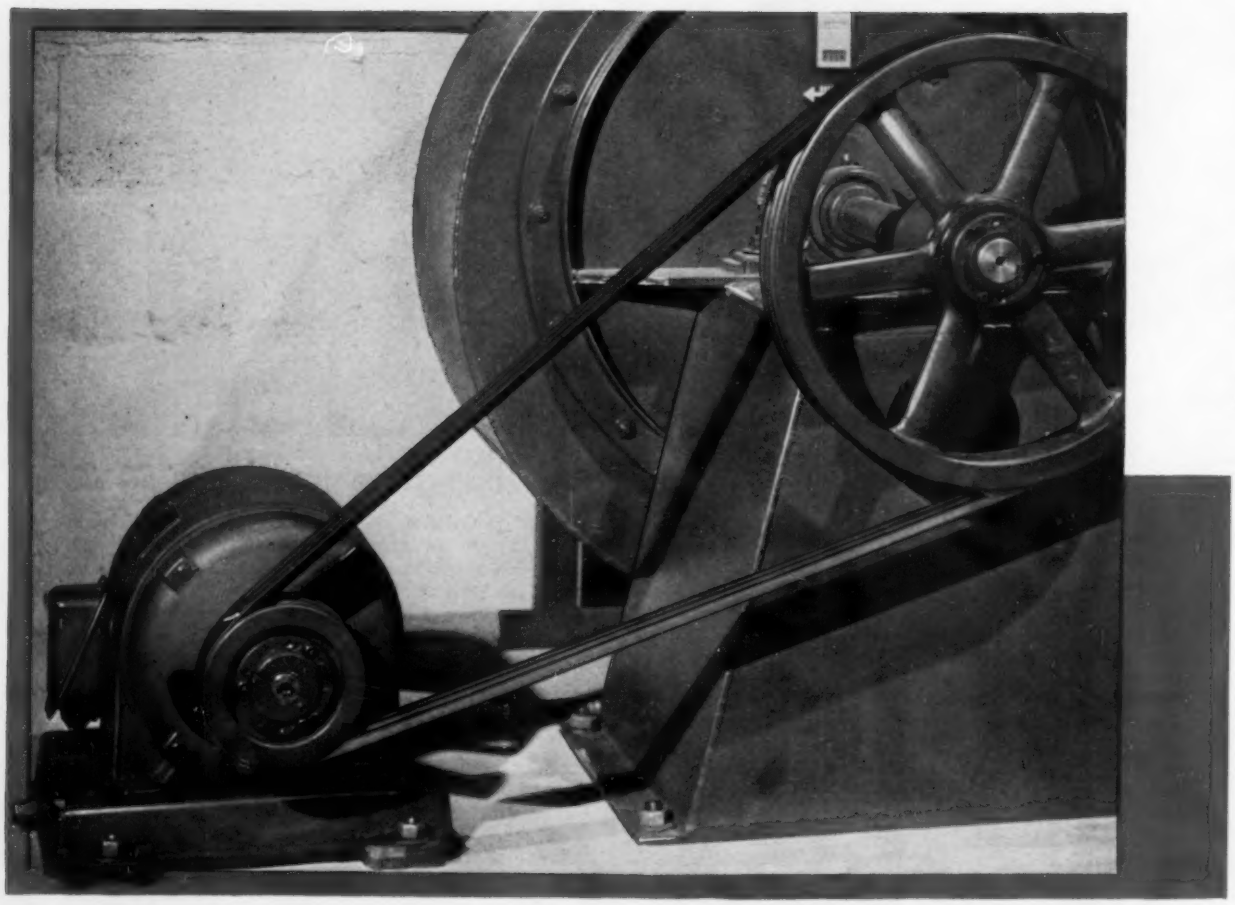
City..... Zone.....

State.....

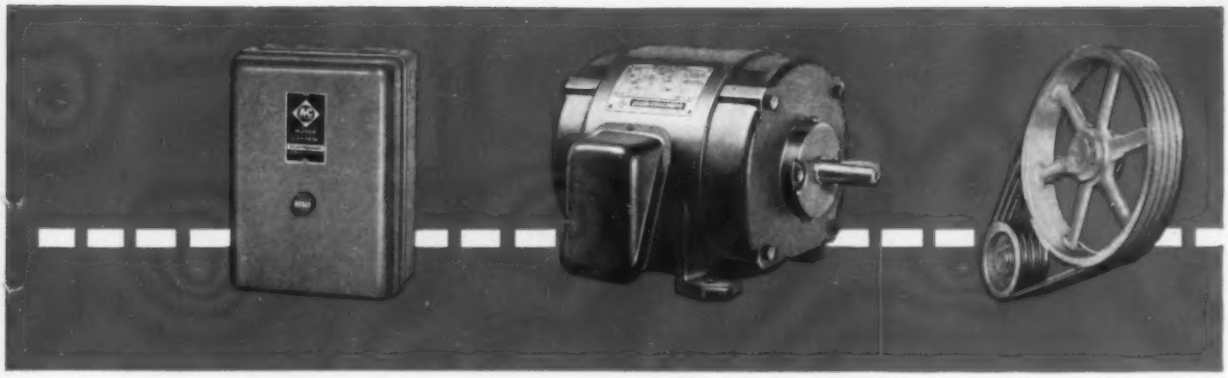
Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

Use this Combination of Control-Motor-Drive

Save Engineering



ALLIS-



...Simplify Service

These Components are Designed to Work Together and They're Backed by Nation-Wide Service

Cut Engineering Time and Cost. Select all components for your complete drive... motor, control and *Texrope* V-belt drive... from one source. All ratings are coordinated to make selection easier. Parts match up properly.

Reduce Installation Costs. Parts fit together easily at assembly because they are designed and built to be used together... to fit a single set of standards. And, of course, you have one responsibility for the performance of the complete drive unit... one reliable guarantee of satisfaction.

Get Nation-Wide Service. Allis-Chalmers continues to serve you and your customers after your equipment is installed. In addition to 76 district offices, there are almost one hundred Certified Service Shops located in every industrial area in the country. These shops are carefully selected, independent shops that use only factory-approved parts and methods in servicing Allis-Chalmers equipment.

For an experienced specialist to help you select the best drive for your installation... for coordinated equipment... call your nearby Allis-Chalmers District Office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Send for FREE engineering literature

Control

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Motors

Handy Guide to Motor Selection	51B6052
Squirrel-Cage Motors	51B6210
TEFC Motors	51B7225

Texrope Drives

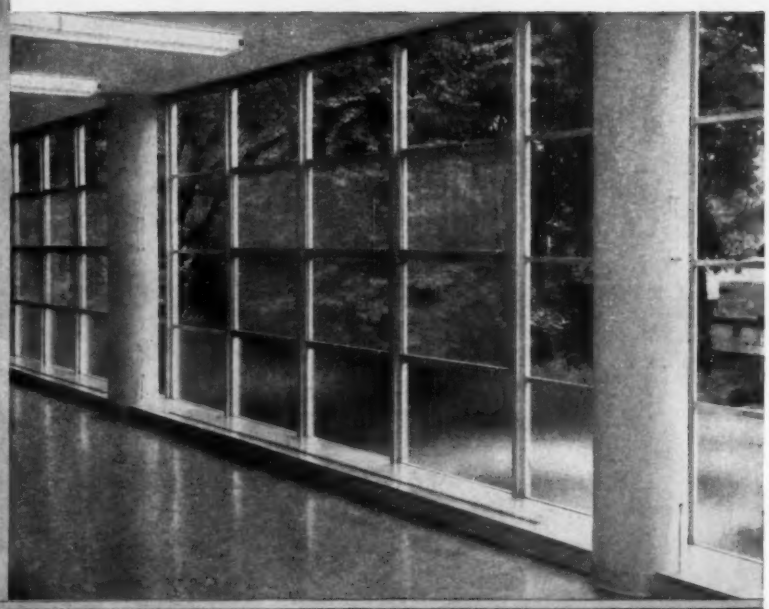
Handy Guide to *Texrope* Drives	20B6051

CHALMERS

Texrope is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

Blend It...
Hide It...
Combine It...



Installed as a continuous strip in window head or sill (as above), AGITAIR STRIPLINE is the only practical means for air curtaining plate glass windows or wall areas to counteract summer heat or winter chill.

AGITAIR® STRIPLINE DIFFUSERS

BLEND IT . . . specify AGITAIR STRIPLINE as a continuous decorative unit, or in sections to meet any requirements of interior treatment.

HIDE IT . . . in shallow lighting coves for perfect concealment.

COMBINE IT . . . with unit or continuous lighting fixtures.

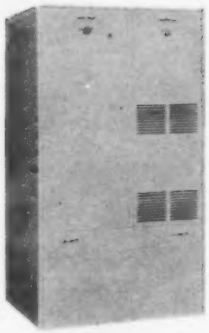
AND REMEMBER . . . no matter how you use it — AGITAIR STRIPLINE diffusing vanes create maximum mixing and aspiration . . . quick temperature equalization . . . and correct air distribution over any desired length.

Every Inch a Diffuser . . . the Vanes Make the Difference

AIR DEVICES INC.

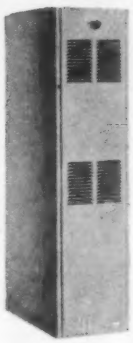
185 MADISON AVENUE, NEW YORK 16, N. Y.

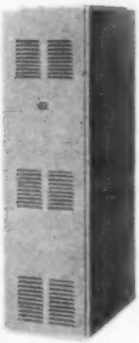
AIR DIFFUSERS • FILTERS • EXHAUSTERS



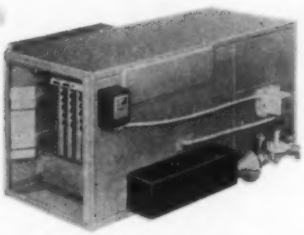
HEATING—COOLING COMBINATIONS

VERTICAL FORCED AIR FURNACES





COUNTERFLOW FORCED AIR FURNACES



HORIZONTAL FORCED AIR FURNACES

add profits with

WEATHERAMIC

in bank note green

You naturally expect superior performance of Utility—and the new Weatheramic series lives up to that reputation.
But it also offers you the exciting plus of color—Bank Note Green! This handsome, durable finish, with its eye-catching, heart-warming, sales-winning ways, has an appeal you can bank on—with results you can bank! Weatheramic forced air heating and air conditioning units deliver every Utility advantage—high efficiency, a trouble-free life that reinforces your good reputation, and engineering that anticipates tomorrow's functional design and solves yesterday's installation problems. Weatheramic by Utility!

Weatheramic LINE

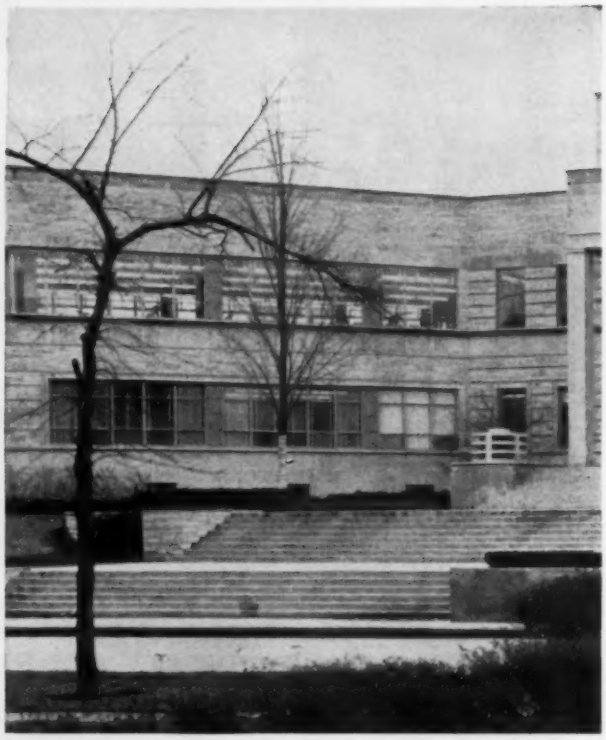
UTILITY

FORCED AIR FURNACES/AIR CONDITIONERS

UTILITY APPLIANCE CORPORATION 4051 south alameda street, los angeles 58, california

Where water must be heated or cooled ...and circulated quietly, specify

Hydro-Flo* **products**



Rotary International Building, Evanston, Illinois, employs B&G Universal Pumps and Heat Exchangers in the combination heating and cooling system.

Architects: Maher & McGraw, Evanston, Ill....Construction Engineers: Noller, Rich & Bladen, Chicago...Heating & Air Conditioning: C. W. Johnson, Inc., Chicago... Plumbing: O'Callaghan Bros., Chicago.

The trend to water as both the heating and cooling medium in modern buildings establishes a positive requirement which must be met by the circulating equipment. *Quiet operation of the pumps is all essential!*

The B&G Universal Pump is specifically designed and built to meet this prime requirement of liquid heating and cooling systems. It is not an ordinary commercial centrifugal pump! No special vibration eliminators or flexible connections to the piping are needed...noise and vibration have been engineered out! *You have to touch a B&G Universal to tell if it is running!*

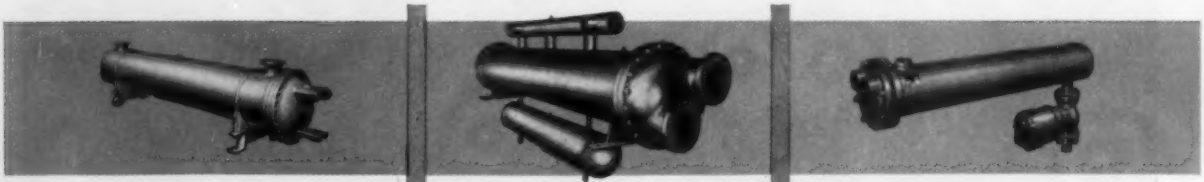
In the building illustrated above, B&G Universal Pumps are used to circulate all water, including that in the chiller and cooling tower circuits. The same piping system is used to circulate hot water in winter and cooled water in summer. Convectors with adjustable speed fans act as room distributing units. Water for the heating system is heated with steam in a B&G Type "SU" Heat Exchanger.

BELL & GOSSETT
COMPANY

Dept EB-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, W. Toronto, Canada

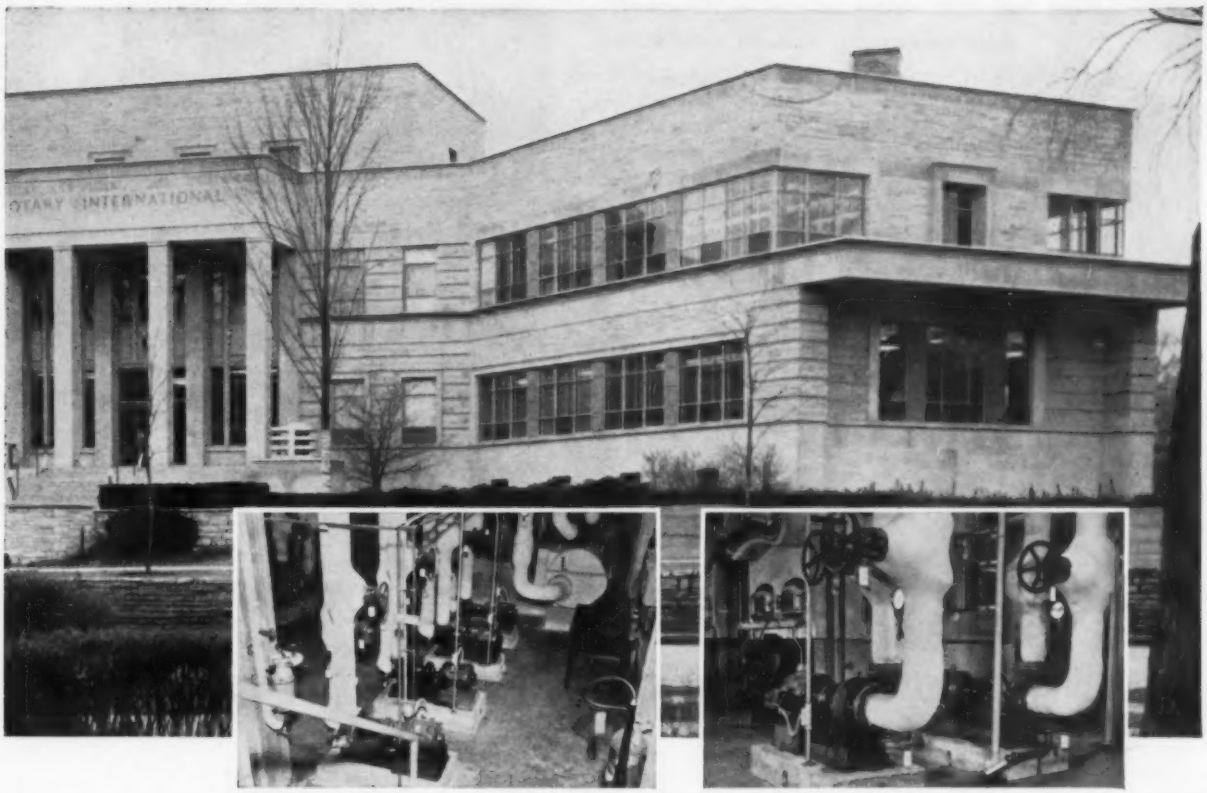
*Reg. U.S. Pat. Off.



B&G Evaporators
Unique design prevents oil trapping in the head passes. Easy to install and insulate. Built to ASME Code.

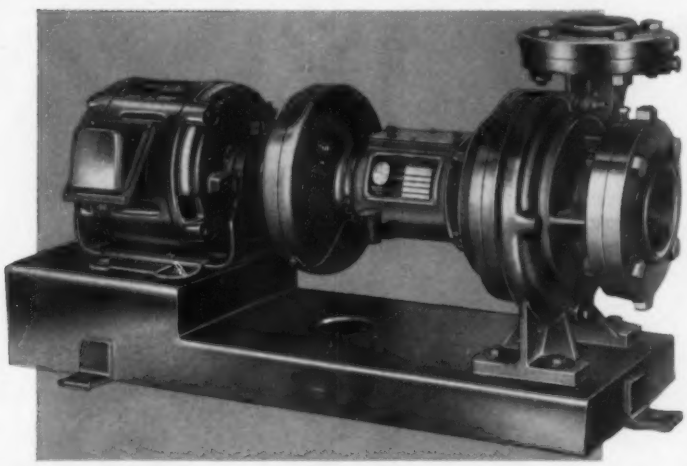
B&G Condensers
Time-tested design and rugged construction assure top performance over a long service life. ASME Code constructed—certified by Hartford.

B&G Type "WU" Heat Exchangers
Boiler water is pumped through the "WU", greatly increasing capacity and permitting close control of service water temperature. Reduces material and labor—no tank needed.



Battery of B&G Universal Pumps for circulating hot and cooled water through system.

Circulation from chiller to cooling tower is handled by B&G Universal Pumps.



For quiet operation... the B&G Universal Pump

In every detail, the B&G Universal Pump is designed for *silent, vibrationless* operation. The motor is specially constructed, tested and *hand-picked* for quietness. Sleeve bearings in both pump and motor . . . suspension in ring-type rubber mountings and flexible spring couplers, all contribute to quiet operation. Other features include the leakproof "Remite" Seal, oil lubrication and hydraulically balanced impeller. The removable bearing frame permits servicing without breaking pipe connections—*all the advantages of split case design!*

Send the coupon for complete data.

B&G Type "SU" Heat Exchanger

For steam to water heat transfer. Generous heat transfer surface heats water instantly as required. Wide capacity range meets all water heating requirements.

BELL & GOSSETT COMPANY, Dept. EB-5, Morton Grove, Ill.

Please send literature as checked—

☐ Universal Pumps ☐ Evaporators ☐ Condensers

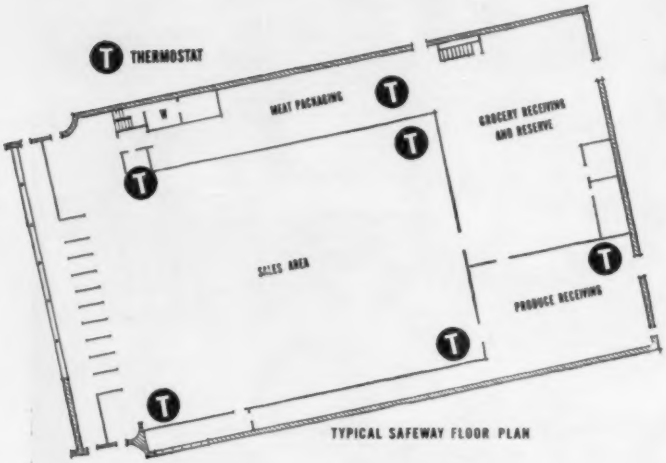
☐ "SU" Heat Exchangers ☐ "WU" Heat Exchangers

NAME.....

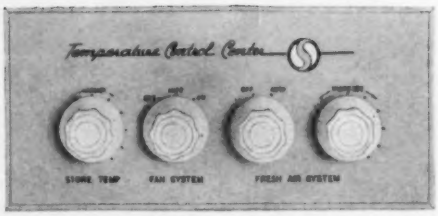
ADDRESS.....

CITY.....*ZONE*.....*STATE*.....

New Safeway stores get most advanced comfort control system available



TYPICAL SAFEWAY FLOOR PLAN



Electronic panel, specially designed for Safeway stores, gives complete control of heating, cooling, ventilating and humidifying equipment to the Safeway store manager. In addition, Honeywell Electronics ideally meets basic Safeway control requirements – year-round air conditioning in main shopping areas, cooling *and* humidity control in produce storage rooms. Only electronics could supply other advantages wanted by Safeway management, listed opposite. Typical Honeywell installations are in eight new Safeway stores on the west coast.

Honeywell Electronics makes commercial building

Safeway Food Store, Walnut Creek, Calif. Architect: Arthur A. Iwata, Berkeley. Consulting mechanical engineer: Maurice R. Archer, Oakland. Electrical engineer: Ray Williamson, Oakland. General contractor: MacDonald, Young & Nelson, San Francisco. Mechanical contractor: Atlas Heating & Ventilating Co., San Francisco.

Major advantages of Honeywell Electronic Customized Temperature Control

Central Control. Special Honeywell panel provides a compact supervisory control center. Adjustments are made *at the panel.* Panel access may be free, or restricted to building manager or one trained employee to prevent tampering. *Electronics makes central control economically feasible.*

Averaging. It's easy to maintain even temperatures in uncompartmented areas; just place inexpensive electronic thermostats wherever they're needed. Heating-cooling plant is controlled by the average reading of the several thermostats. Only one setting is required.

Outdoor compensation is sure and simple. Large glass areas, occupancy, exposure pose no problems; electronic controls meet heating or cooling demands rapidly. Outdoor thermostats anticipate weather changes, eliminate temperature drift in winter, air-cooling shock in summer. Results: consistent comfort, economy.

Automatic changeover from heating to cooling can be achieved with the same thermostat.

Ventilation economizer cycle automatically uses outside air to help carry cooling load, cutting refrigeration costs.

In addition, an electronic system is easy to install. And electronic controls, having no moving parts, are exceptionally long-lived.

any modern

easier to plan, more profitable to operate

Individually designed Honeywell Electronic Temperature Control delivers advantages no other control installation can duplicate

HONEYWELL ELECTRONICS is the latest development in temperature control. It's big news, *important* news, for you and your clients. The case of eight new Safeway food stores in California and Washington shows why.

In meeting control needs peculiar to today's supermarkets, Safeway's planners wanted all the basic advantages of a good control installation, and more. They wanted refinements as modern as their stores—refinements that promised long-range efficiency and safety from obsolescence for many years ahead. Wisely, they chose Honeywell Electronic Customized Temperature Control. Features of the installations and how they function for Safeway stores are briefly described above.

Why electronics? The reason, in a word, is *flexibility.* No other temperature control system adapts so readily to so many specific job requirements. No other system is so efficient—management's assurance of important economies in operating costs, of unprecedented comfort and convenience.

These benefits suggest some of the ways Honeywell Electronic Customized Temperature Control can help you and your clients—in heating, ventilating, air conditioning and industrial control, in any building, new or existing. For the new booklet, "Flexible as a Strand of Wire", giving full information on Electronic Customized Temperature Control, call your Honeywell office. Or write Honeywell, Dept. HA-10-137, Minneapolis 8, Minn.

MINNEAPOLIS **Honeywell**

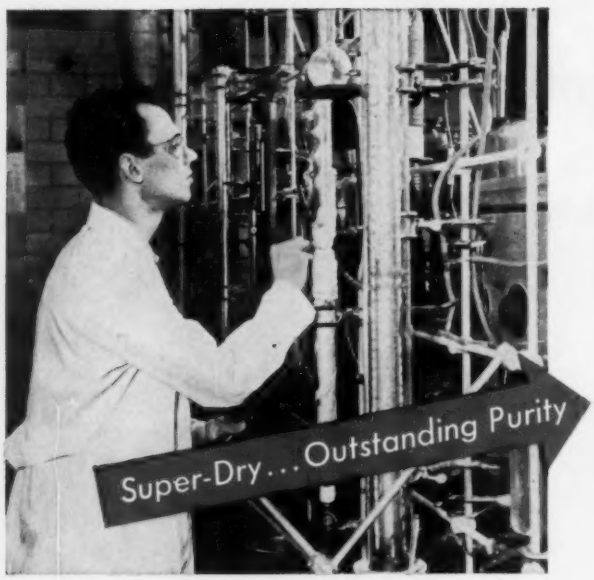
Electronic Controls

112 offices across the nation

APPR

Leading Refrigeration and Air

genetron®



Look at the stringent manufacturing specifications listed here for the principal "Genetrons." Note their exceptionally low moisture content. For example, "Genetron" 12 and "Genetron" 141 are so dry they contain less than ten parts of water per million parts of refrigerant. That's moisture equal to only one thousandth of one percent (0.001%).

The overall purity of "Genetrons" is equally good. See how low they are in non-condensable gases and low boiling impurities. And, remember the quality of current production consistently surpasses even these specifications. No wonder so many leading manufacturers now prefer "Genetrons" as original charge for their equipment!

genetron 12—WHITE LABEL

DICHLORODIFLUOROMETHANE

Quality Specifications

Moisture wt. %, max.	0.0010
Chlorides	none
High boiling impurities—vol. %, max.	0.05
Non-condensable gases (gases insoluble in perchloroethylene)—vol. % in vapor phase, max.	1.5
Boiling pt. at 760 mm. Hg °F.	−21.6
Boiling range °F (to 85% pt.), max.	0.9

genetron 141—GREEN LABEL

MONOCHLORODIFLUOROMETHANE

Quality Specifications

Moisture wt. %, max.	0.0010
Chlorides	none
High boiling impurities—vol. %, max.	0.05
Non-condensable gases (gases insoluble in perchloroethylene)—vol. % in vapor phase, max.	1.5
Boiling pt. at 760 mm. Hg. °F	−41.4
Boiling range °F (to 85% pt.), max.	0.9

genetron 11—ORANGE LABEL

TRICHLOROMONOFLUOROMETHANE

Quality Specifications

Moisture wt. %, max.	0.0015
Chlorides	none
High boiling impurities—vol. %, max.	0.05
Boiling pt. at 760 mm. Hg. °F	74.7
Boiling range °F (to 85% pt.), max.	0.5

OVED!

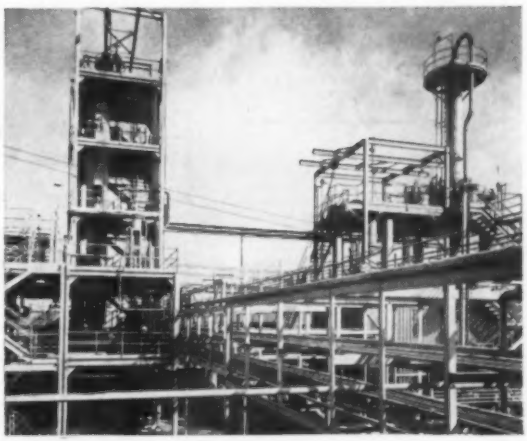
Conditioning Manufacturers All Approve...

Super-Dry Refrigerants

Few products have ever undergone such exhaustive examination as "Genetron" Refrigerants. Leading refrigeration and air conditioning manufacturers have checked and rechecked them intensively . . . proved for themselves that "Genetrons" meet or surpass their most exacting specifications for fluorinated hydrocarbon refrigerants.

Yes . . . in every case . . . "Genetrons" have been certified for the original or replacement charge in America's finest equipment. That's because they have been proved to be—

- **Super-Dry—guaranteed exceptionally low moisture content.**
- **Non-toxic, non-flammable, stable, safe.**
- **Non-corrosive to standard equipment materials.**
- **Critical and freezing points well outside range of operating uses.**
- **Solvent action on oil helps prevent solidification or congealing of lubricant.**
- **Miscible with oil; aid in lubrication of equipment.**
- **Identical and interchangeable in all respects with comparable fluorinated hydrocarbon refrigerants produced by any other manufacturer meeting the same high standards.**



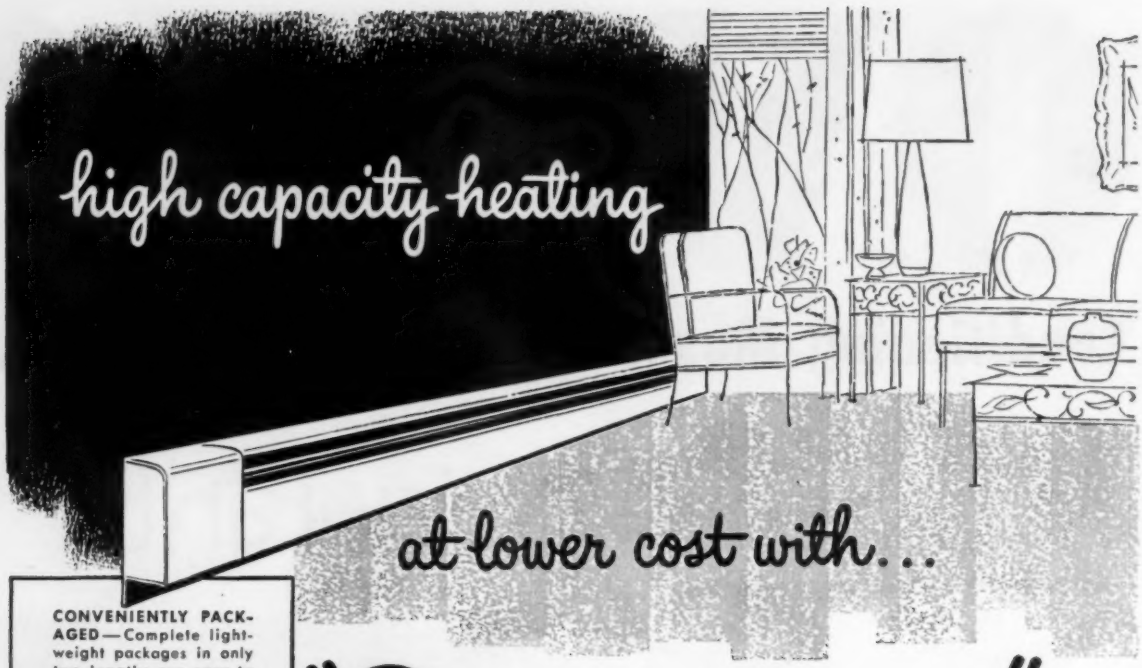
READY SOON:
In addition to its expanded "Genetron" production center at Baton Rouge, La., General Chemical will soon have large new "Genetron" facilities in operation at Danville, Ill. These, plus others in the industry, assure refrigerant capacity to meet all needs for the foreseeable future.

Basic Chemicals for American Industry

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Allied Chemical

See your refrigeration wholesaler



CONVENIENTLY PACKAGED—Complete lightweight packages in only two lengths are easy to stock . . . easy to handle on the job.

SIMPLE TO INSTALL—All components perfectly fitted . . . many simply snap in place. Dampers or air splitter optional.

"Perimaheat"

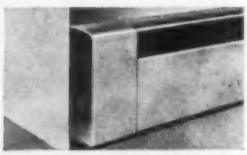
Baseboard Convectors

Advanced *Perimaheat* Baseboard design produces high efficiency heating, the result of more than 28 years of YOUNG specialized heat transfer engineering and experience.

Perimaheat heating elements feature aluminum fins mechanically bonded to copper tubes to form a double-walled continuous metal heat transfer surface that produces maximum heating efficiency. Cushion strip and free-hanging elements eliminate contraction and expansion noises. Smooth, attractive *Perimaheat* Cabinets are easy to keep clean.

For further *Perimaheat* details, see your Young Representative listed in the yellow pages of your telephone directory, or mail coupon below.

JOINT COVER


RIGHT OR LEFT-HAND END CAPS

INSIDE CORNER

OUTSIDE CORNER

Perimaheat is a Young Radiator Company Trade Mark.

The Young Radiator Company is a member of the Convector Manufacturers Association and subscribes to the engineering standards of that association.

CMA

mail coupon for full details

YOUNG RADIATOR COMPANY
Dept. K-515, Racine, Wisconsin
Please send me free *Perimaheat* Baseboard Catalog.

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

Young RADIATOR COMPANY
RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications.

Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

Architects & Engineers: **Welton Becket & Associates** • General Contractor: **Del E. Webb Construction Co.** • Plumbing Contractor: **Scott Co.** • Plumbing Wholesaler: **Grinnell Co. of the Pacific**

No need to dip your toe in this king size pool to test its temperature. Just dive right in and enjoy its filtered, comfortable water. It's thermostatically controlled by Powers.

In the Sumptuous **BEVERLY HILTON**

BEVERLY HILLS, CALIFORNIA

POWERS **THERMOSTATIC CONTROLS**
Regulate Temperature of Swimming Pool, Showers, Shampoos and Water Heaters

Safe, Comfortable Showers, 450 of them in the hotel and colorful pool side cabanas, are thermostatically regulated by Powers. There is no danger of scalding or unexpected shots of cold water.

With its new world standards for hotel luxury, service and hospitality, the Beverly Hilton has provided its guests with the ultimate in comfort and safety in its Powers thermostatically controlled showers, shampoos and swimming pool.

More Powers to You when you want controls of superior quality that give years of dependable performance. Benefit from Powers more than 60 years of experience in temperature control. Call our nearest office or write us direct for aid in selecting the right type of control for your requirements.

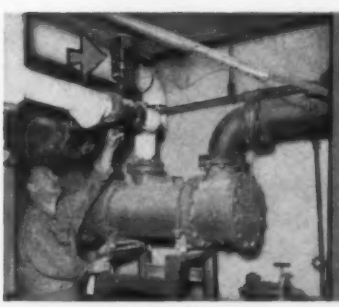
(c47)

No Danger of Scalding in the Barber Shop Shampoos. They're safetyized by Powers.

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

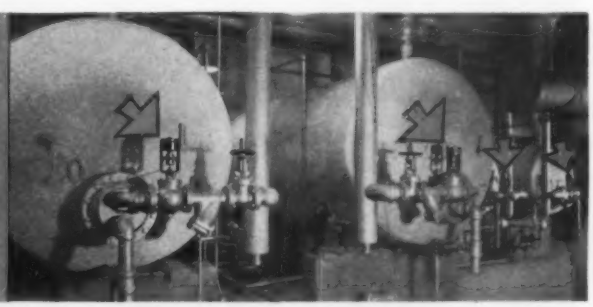
Over 60 years of Automatic Temperature and Humidity Control

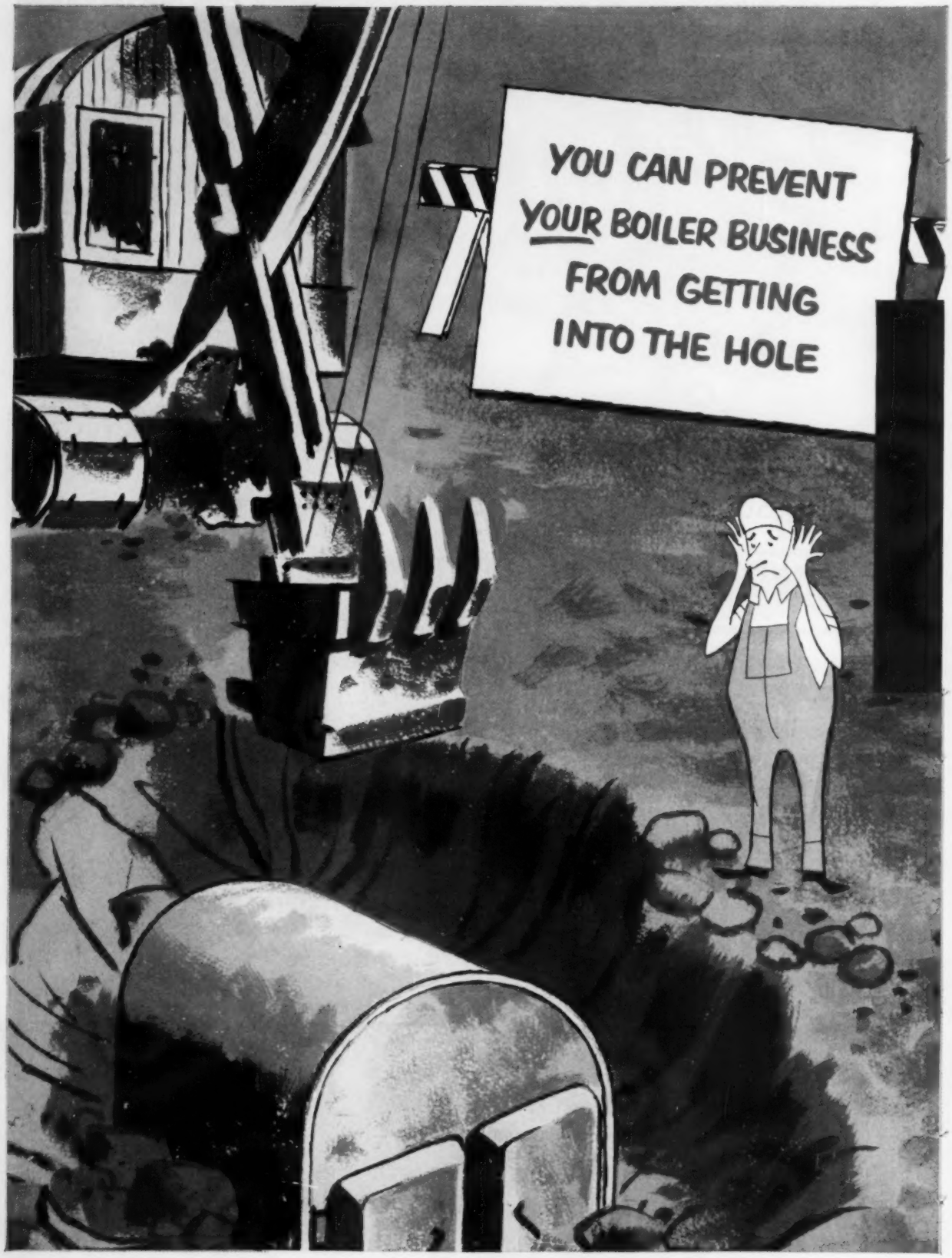


5 of the 8 Powers Controlled Water Heaters

Heat Exchanger, left, supplies properly tempered water to swimming pool.

Water Storage Heaters, right, are also controlled by Powers No. 11 Self Operating Temperature Regulators.




YOU CAN PREVENT
YOUR BOILER BUSINESS
FROM GETTING
INTO THE HOLE

Here's a real product advantage that will enable you to land more installations on new construction than ever before. Show the builder that he can save the cost of digging the pit required for conventional commercial boilers . . .

install the unique

SPENCER "LW"

Lower waterline—over-all height of the Spencer "LW" is approximately 25% less than conventional firebox boilers . . . saves excavation costs in new buildings by eliminating pit usually required.

Built in two sections—in existing buildings, divided design permits entry through narrow basement openings without tearing out walls. The two watertight sections are moved in separately with no welding for installation.

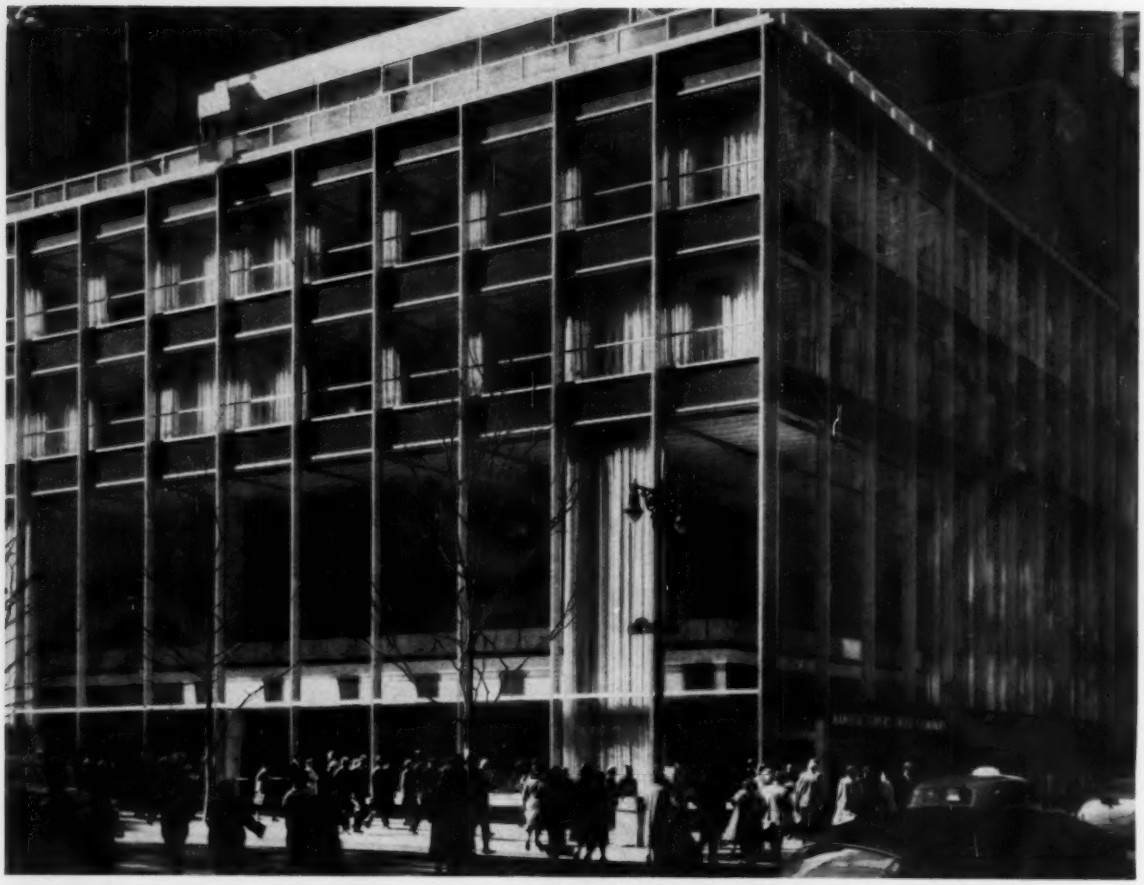
Let Spencer build up your boiler business—write Dept. HP-105

New Spencer "C." Heavy-duty commercial boiler performance at a residential boiler price! Can be fired with oil, gas or coal.

Spencer "A." Complete range of sizes from 3,500 to 50,000 sq. ft. steam, net SBI ratings. For *every* building . . . for *every* fuel.

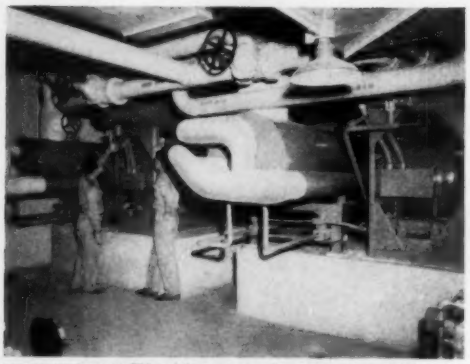
SPENCER
HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

ASME and SBI Approved SBI



GLASS-SHEATHED Manufacturers Trust Building in New York is fully air conditioned by a Worthington central station system.

New "glass bank" air conditioned by Worthington



TWO 150-TON Worthington packaged water chillers in basement handle entire cooling for new bank building.

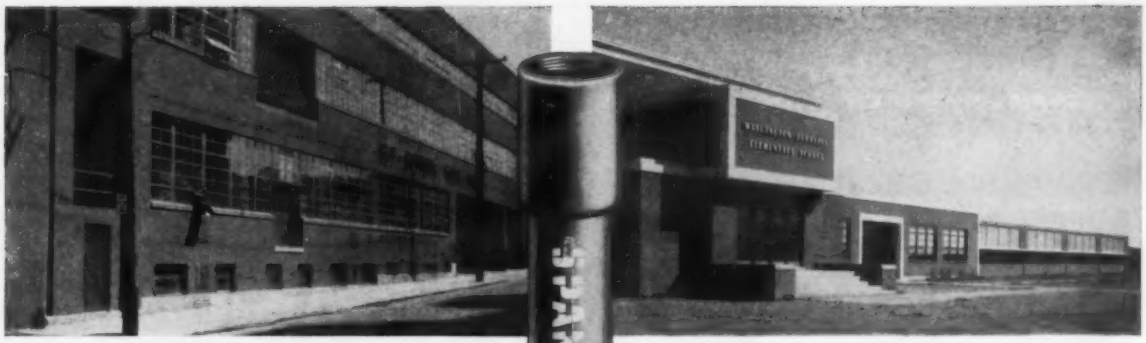
Polished aluminum and the largest panes of glass ever made in this country highlight this striking new building housing the Fifth Avenue office of Manufacturers Trust Company.

This vast expanse of glass posed a tough air conditioning problem. The job is taken in stride, however, by a modern Worthington central station system consisting of two 150-ton packaged water chillers. These chillers circulate water to a central air distribution system; from there, cool, filtered, dehumidified air is sent throughout the building.

For over half a century, Worthington air conditioning installations have been serving business and industry. Today, the complete Worthington line is ready to meet any assignment, large or small. Get in touch with your nearest Worthington district office or write to Worthington Corporation, Section A.5.20.HP, Harrison, N.J. A.5.20

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME



For heating and plumbing
at Ortlieb Brewing Company, Philadelphia, Pa. . . .

. . . radiant heating
at Washington-Douglass School, Jackson, Tenn. . . .

. . . snow melting
at a private residence, Syracuse, N. Y. . . .

. . . sprinkler system
at Collyer Wire Co., Pawtucket, R. I. . . .

. . . ice rink freezing
at Field House, Middlebury College, Vt. . . .

. . . air conditioning
at Kroger's Supermarket, Atlanta, Ga. . . .

it's SPANG® CW Steel Pipe

Manufactured under SPANG's strict *quality-control* conditions and doubly inspected before shipment, SPANG CW Steel Pipe is a *top-quality* product that is easy to cut, bend, thread and weld . . . gives you fast, trouble-free installations . . . keeps installation costs low . . . always assures years of dependable service in *every* type installation.

Next time you order pipe, cash in on these advantages. Specify SPANG CW Steel Pipe. See your local SPANG Distributor for *top-quality* service and delivery!

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Office: Two Gateway Center, Pittsburgh, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

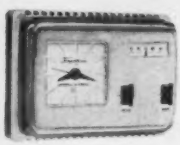
Every Combination

—with GENERAL CONTROLS

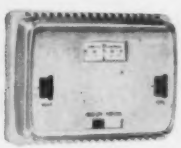
Beautiful Slim Silhouette Room Thermostats

175 Low Voltage Thermostat... heat leveling room thermostat, standard with field-proved "Magic Dial."

T-99 Standard Thermostat... mercury switch type. Hermetically sealed contacts. Heat anticipating.



T-270 Tempotherm Clock Thermostat... day and night settings with electric clock changeover control. Set it once and forget it.



T-231 Combination Heating and Air Conditioning Thermostat... provides single-point control for combination heating and cooling systems. Other combinations available.

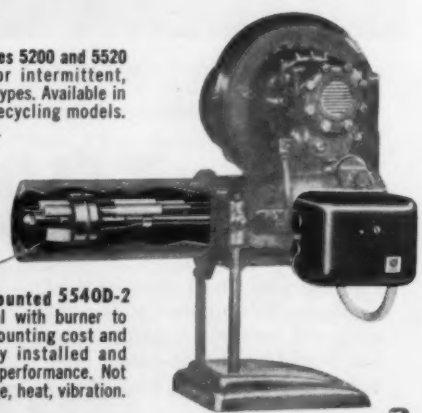
The Finest Oil Primaries — 3 Ways

1.

Stack-Mounted Series 5200 and 5520 ... for constant or intermittent, pressure or rotary types. Available in non-recycling or recycling models. No leveling needed.

2.

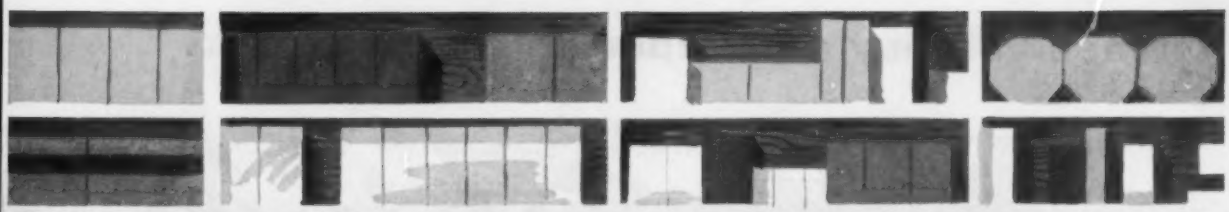
Proved Burner-Mounted 5540D-2 PerfXray... integral with burner to eliminate stack-mounting cost and problems. Factory installed and tested for perfect performance. Not affected by soot, age, heat, vibration.



3.

Two-Piece Stack/Burner-Mounted Series 5555D-2 ... same high quality, long life construction as one-piece design with added convenience of two-piece installation to simplify mounting, lower costs.

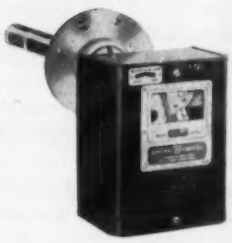
* PerfXray and remote stack element interchangeable with burner-mounted relay



A Perfect Package

plus PERFEX you're always right...automatically!

Top Quality Fan, Limit or Combination Controls



L-34 Fan and Limit Control ...mercury switch, helix type. Independent switches and settings. Optional summer fan switch. Liquid level for accurate positioning.

480 Fail-Safe Fan and Limit Control... liquid charge—remote single bulb type operates fan and limit switches.

474 Fan and Limit Control ...helix, bimetal type. Separate fingertip settings. Standard with summer fan switch.

L-44 Fan and Limit Control ...helix type with independent snap switches. Fast response to temperature changes.

General Controls

Oil Burner Control Systems

There is an obvious advantage in selecting heating controls from a single source—where compatible design and undivided responsibility guarantee satisfaction. When that single source offers the great selection and unquestioned superiority of General Controls and Perfex quality—your advantage is increased tenfold. And when you add the unmatched support you get—from 5 plants geared to produce in volume, 7 regional warehouses placed to meet your emergency needs, and 40 branch offices standing by for minute-man service and counsel—you can easily see why more and more men in your position standardize on General Controls automatically... *to be sure!*

THE MOST COMPLETE LINE OF AUTOMATIC CONTROLS IN THE INDUSTRY
—for any system... gas, oil, electric, coal

Write for complete General Controls/Perfex catalogs today

GENERAL CONTROLS

MANUFACTURERS OF AUTOMATIC CONTROLS FOR HOME, INDUSTRY AND THE MILITARY

GENERAL CONTROLS • PERFEX CONTROLS

40 FACTORY BRANCH OFFICES SERVING THE UNITED STATES AND CANADA

FIVE PLANTS: IRON MOUNTAIN, MICHIGAN
GLENDALE, CALIFORNIA • BURBANK, CALIFORNIA
SKOKIE, ILLINOIS • GUELPH, CANADA

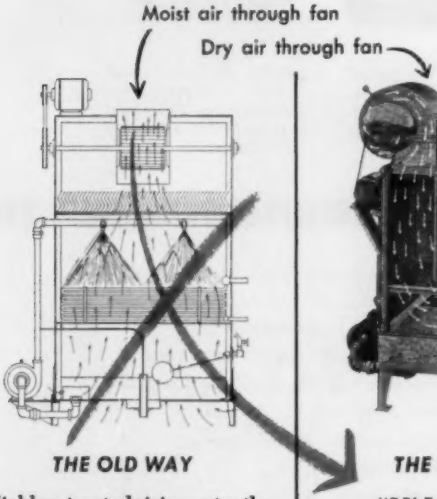
When you buy an evaporative condenser...

Think YEARS AHEAD

If you don't think years ahead you may find yourself burdened with costly problems. For example: corrosion and scaling, deteriorated fans, exorbitant repair bills, days of down-time all caused by moist air continually pulled through the fan section. The way to avoid these future problems is to specify dependable *"Dri-Fan"* by RECOLD. *"Dri-Fan"* is the Evaporative Condenser that pushes *dry air* through the fan section, eliminates corrosion problems, gives you long trouble-free performance. Check the exclusive, patented RECOLD features and see why more and more the order is for *"Dri-Fan."* Available for Freon 12, Freon 22, and ammonia in capacities from 5 to 150 tons, single or multiple circuit installations.

- ***Engineered for quiet operation***
- ***Galvanized construction***
- ***Desuperheat coil available***
- ***Easy to install and service***

"Dri-Fan" Cooling Towers provide the same advantageous construction.



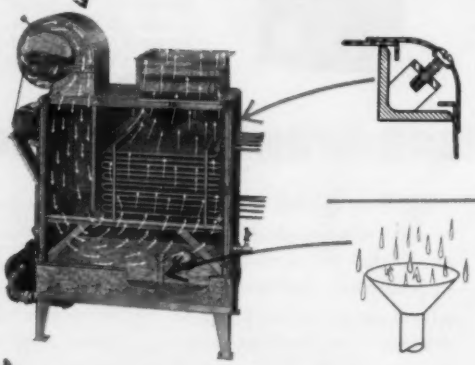
THE OLD WAY

Highly saturated air is constantly pulled through the vulnerable fan section causing corrosion, scaling, deterioration of the fan, shaft and bearings.

THE RECOLD WAY

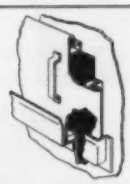
"DRI-FAN" ELIMINATES CORROSION PROBLEMS

RECOLD uses the forced draft principle to push dry air through the condenser. The fan operates in the dry air stream.



Think about serviceability— RECOLD advanced cabinet design provides water-tight panels that are quickly and easily removed.

Think about bleed control— RECOLD "funnel" design assures positive, non-clogging action with scale control and minimum water loss.



Think about accessibility— Patented access door slides easily, provides water-tight seal without use of gaskets or fasteners.

For illustrated folder on RECOLD "DRI-FAN" *Evaporative Condensers or Cooling Towers, write to your Recold distributor or to...*

Recold

"DRI-FAN" Trade Mark registered

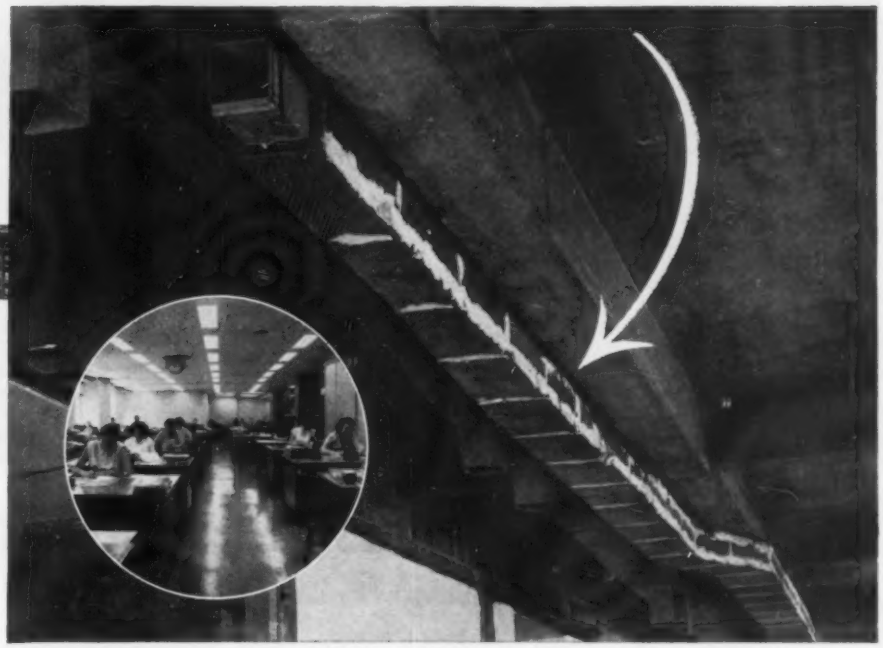
REFRIGERATION ENGINEERING, INC.

Department K1

7250 EAST SLAUSON AVENUE, LOS ANGELES 22, CALIFORNIA

Above: New York City's new Chrysler Building East (foreground) and the original Chrysler Building erected some 20 years ago.

On air-conditioning ducts serving 420,000 sq ft of office space . . .



Right: Spintex insulation on the air-conditioning ducts serving offices in the Chrysler Building East. Applied by the Asbestos Construction Company, Inc. of New York, an outstanding J-M Insulation Contractor.

CHRYSLER BUILDING EAST SPECIFIES J-M *Spintex* DUCT INSULATION FOR YEAR 'ROUND OFFICE COMFORT

Running through the 32 stories of the new companion structure to the original Chrysler Building are miles of air-conditioning ducts . . . all insulated with Johns-Manville Spintex.

Spintex was chosen because it helps assure the greatest office comfort at the lowest operating cost. It has low thermal conductivity . . . plus resistance to moisture, fire, rot and mold growth. It is one of the most effective insulations for guarding against heat transfer and moisture accumulation.

Johns-Manville flexible, semi-rigid and rigid insulations for air-conditioning ducts meet every industrial requirement. Basically mineral products, each type has its particular characteristics that make it specially suitable for a specific air-conditioning service. All have the low heat transfer properties that are needed for high insulating efficiency.

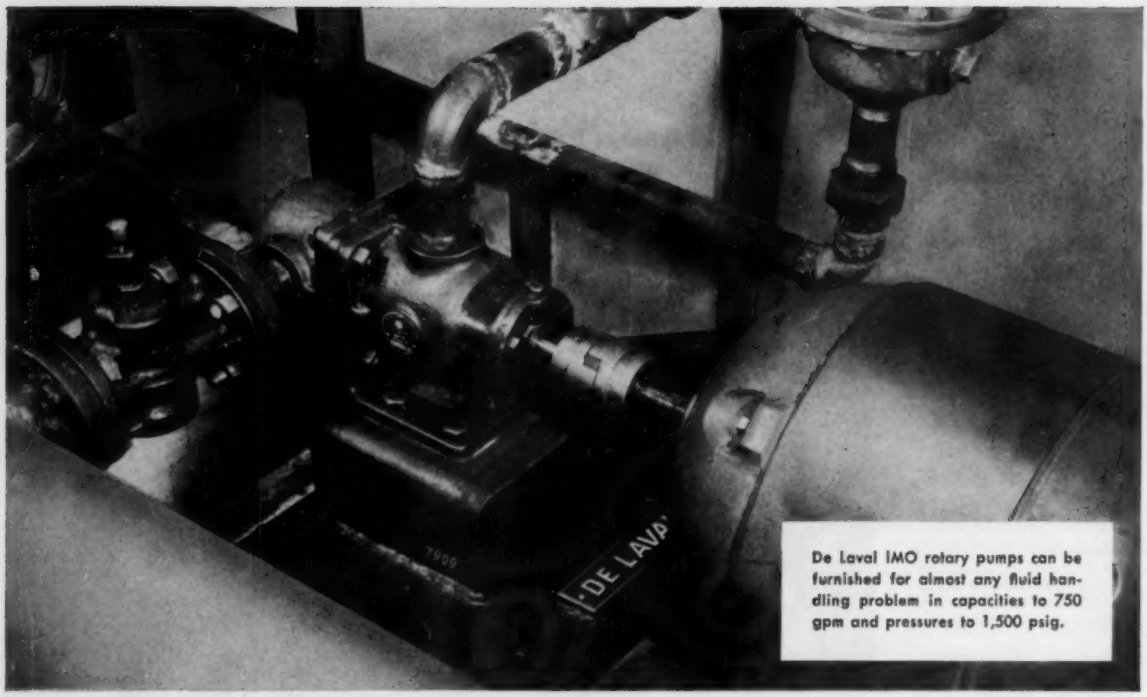
Proper engineering and application are essential to the peak performance of any insulation. J-M Insulation Engineers and J-M Insulation Contractors stand ready to give you a top quality insulation job that will more than pay off your initial investment with maximum fuel savings.

For further information, write for a copy of Brochure IN-135A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ont.

J-M insulation applicators applying Spintex on an air-conditioning duct. Thoroughly familiar with J-M insulating materials and application methods, these men have the skill that assures maximum dividends in greater fuel and power savings over the years.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION



De Laval IMO rotary pumps can be furnished for almost any fluid handling problem in capacities to 750 gpm and pressures to 1,500 psig.

What to Look for in a Rotary Screw Type Pump

By W. J. MONCON, *Assistant Chief Engineer*
De Laval Steam Turbine Company

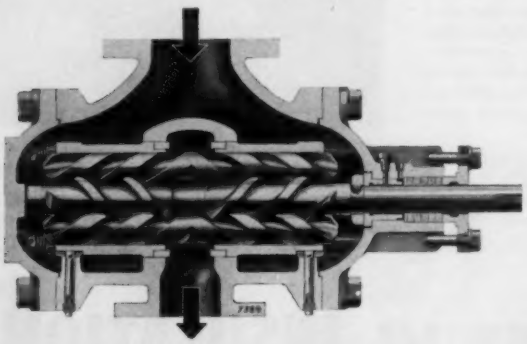
A sound knowledge of design, and how it affects performance, is the best insurance a buyer can have that he will get the pump he needs. This brief analysis of the IMO, a rotary three-screw pump manufactured by the De Laval Steam Turbine Company, will give you some of the necessary facts.

What qualities should you look for in a rotary type pump? It must, of course, meet specified capacities and pressures. But, it must also be efficient, operate quietly, stay on the job.

The axial flow of a screw type pump, and the resulting low inlet losses for any given pump speed, are important benefits that should be considered in making pump selections. The absence of timing gears and other mechanical features of construction also enable the De Laval IMO pump to operate at direct-connected motor and turbine speeds . . . to handle viscous liquids and high suction lifts.

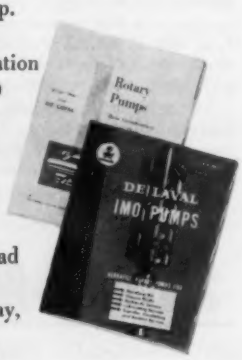
One of the most important features of the IMO pump is the hydraulic turning of the idler or sealing rotors. The central or power rotor is the pumping element; the liquid pumped turns the sealing rotors.

A screw type pump is well suited for applications where pulsation-free flow is desirable. The axial flow of the liquid without trapping and the unique thread form which keeps closures fluid-tight contribute to quiet operation of the IMO pump.



De Laval IMO Series A322A, a positive displacement, rotary screw type pump, can handle capacities to 750 gpm and pressures to 150 psig.

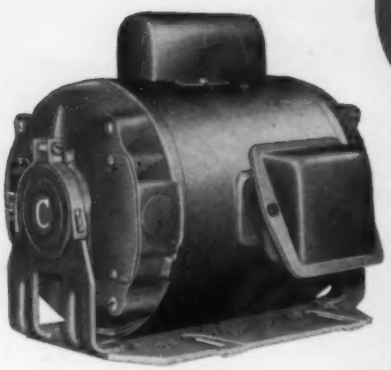
Catalog LS gives useful application and specification data on the IMO pump. An article titled, *Rotary Pumps, Basic Considerations in Their Application*, contains a description of rotary pumps in general. For these publications, write on your company letterhead to De Laval Steam Turbine Company, 871 Nottingham Way, Trenton 2, New Jersey. DL-301



Your choice of normal or low starting current... with Performance-Rated

Century

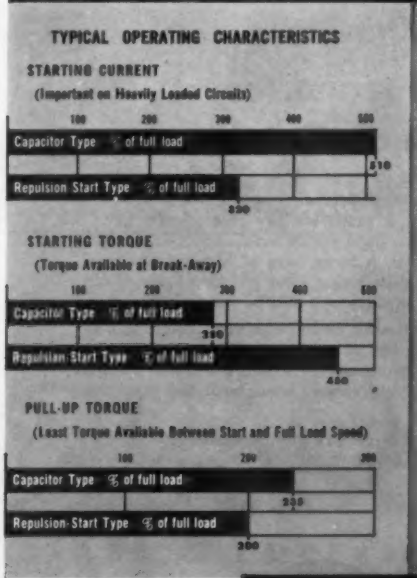
HIGH TORQUE, SINGLE-PHASE MOTORS



Capacitor Motors... ⅛ to 20 H.P. provide high starting torque, high pull-up torque and require normal starting current. They are available in drip proof, dust proof and explosion proof enclosures.

Even if you have severe starting current limitations, you can select the torque you need for sure starts and smooth pull-up to speed from the Century Performance-Rated Single-Phase line (see bar chart below for operating characteristics of two types of Century Single-Phase Motors).

Whatever Your Motor Job . . . there's a Century Motor Performance-Rated to handle it with top effectiveness. Contact your nearby Century branch office or Authorized Distributor.



Repulsion Start, Induction Motors (type RS)... ½ to 7½ H.P. provide very high starting torque, yet require unusually low starting current. They are available in drip proof and splash proof enclosures.

Performance-Rated© Motors ⅛ to 400 H.P.

CENTURY ELECTRIC COMPANY

CE-32

1806 Pine Street, St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*

McQuay...

announces opening of its new plant in Grenada, Mississippi

Faribault Plant
4th St. and Park Ave.
Faribault, Minnesota

General Offices and Warehouse
1600 Broadway St. N.E.
Minneapolis, Minnesota

Formally opened for production on October 3

In the 167,000 square feet of space in our new Grenada, Mississippi, plant we have installed the most up-to-date machinery and equipment known to the industry. A large part of McQuay's Heating, Air Conditioning, and Refrigeration Coils as well as unitary equipment will be made here.

These new facilities enable us to offer you faster, more efficient service in the manufacture and distribution of the high quality products for which the name McQuay is so well and favorably known throughout the country.

We know you'll find a trip through the plant a pleasant and profitable experience. Plan for a visit when you can.

Write McQuay Inc. for engineering assistance on any coil problem.

McQuay INC.

AIR CONDITIONING
REFRIGERATION
HEATING

1601 Broadway St. N. E., Minneapolis 13, Minnesota

NEW!

EASY-HANDLE CARTON . . .

for the famous easy-handling Chase Copper Water Tube!

What a combination! Top-quality Chase copper water tube in a new carton that's *more convenient than ever*. It's easier to carry, easier to identify, easier to store compactly!

Square hole in carton's middle is a secure finger or arm grip. All information is clearly printed in *big*, INDUSTRY-APPROVED, COLOR-CODED LETTERING—on top, bottom and sides. Type L is blue-coded; Type K, green-coded. Carton can be rolled easily, yet stands on end steady as a rock. And the rugged one-piece construction of the carton completely protects the 60-foot coils of Chase copper water tube from damage!

You get *this* tube clean, bright and perfectly tempered for easy hand bending. Whether you use it with Chase Solder-joint or flared fittings, you can count on permanently leak-free joints—and a better job every time.

All Chase wholesalers will soon have green-coded Type K and blue-coded Type L copper water tube in the *new easy-handle carton*—in the sizes you need.

SEE NEXT PAGE

Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper (†sales office only)

Albany†	Chicago	Detroit	Los Angeles	New Orleans	Rochester†
Atlanta	Cincinnati	Grand Rapids†	Louisville†	New York	St. Louis
Baltimore	Cleveland	Houston	Milwaukee	Philadelphia	San Francisco
Boston	Dallas	Indianapolis	Minneapolis	Pittsburgh	Seattle
Charlotte†	Denver	Kansas City, Mo.	Newark	Providence	Waterbury

Ask for Chase® Copper Water Tube in NEW COLOR-CODED CARTONS!

WHOLESALERS! CONTRACTORS!

You save time handling Chase copper water tube in its compact package. For in addition to being *easy to handle*, Chase's unique marking with the industry-approved COLOR-CODING makes the cartons EASY TO IDENTIFY, TOO! You can distinguish between blue-coded Chase Type L or green-coded Chase Type K cartons in a jiffy—even in dim light!

TYPE L SOFT TEMPER CHASE COPPER WATER TUBE
In BLUE-CODED CARTON

Ideal for radiant heating and general plumbing purposes, with solder-joint and flared fittings. Available in cartons in 60-foot coils—¼"-⅜"-½"-¾"-1" diameters.

TYPE K SOFT TEMPER CHASE COPPER WATER TUBE
In GREEN-CODED CARTON

Best compromise between high corrosion resistance and low cost. For house replacements, underground service lines, oil burner work. Available in cartons in 60-foot coils—¼"-⅜"-½"-¾"-1" diameters.

Chase®

BRASS & COPPER CO.

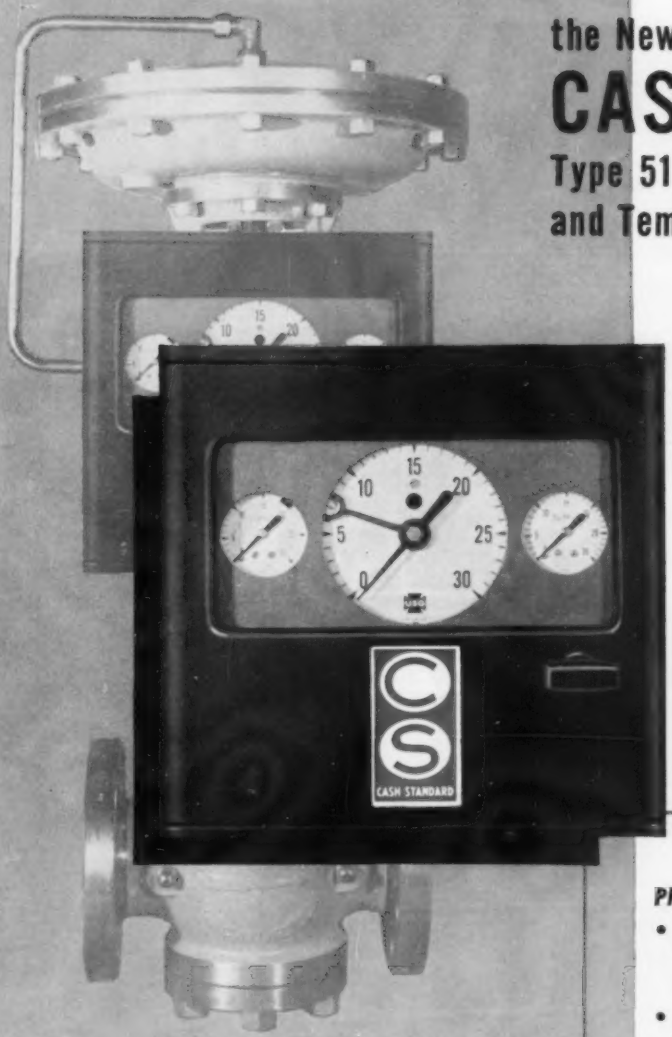
WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

All Chase® Wholesalers will soon have Types K and L Copper Water Tube in the new easy-handle carton. Order from them today!

The Nation's Headquarters for Brass & Copper

Albany† • Atlanta • Baltimore • Boston • Charlotte† • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Grand Rapids† • Houston • Indianapolis • Kansas City, Mo. • Los Angeles
Louisville† • Milwaukee • Minneapolis • Newark • New Orleans • New York • Philadelphia • Pittsburgh • Providence • Rochester† • St. Louis • San Francisco • Seattle • Waterbury • (†sales office only)

PROVIDES PRECISE, DEPENDABLE CONTROL OF PRESSURE AND TEMPERATURE . . .



Cash Standard Type 51 Pilot can be ordered separately or mounted on a Cash Standard Control Valve (Illustration is one example).

the New CASH STANDARD

Type 51 Pressure Pilot and Temperature Pilot

- Process pressure or temperature gauge incorporated in the pilot
- Calibrated set point adjustment
- Unit construction
- Feedback proportional control—1 to 100% proportional band and differential gap
- Available with proportional, plus automatic reset action
- All-metal, frictionless power relay
- Sapphire nozzle feed orifice with push button cleaner

A WIDE SELECTION OF PRESSURE AND TEMPERATURE RANGES

- Pressure-sensing elements available in phospor bronze, beryllium copper or stainless steel

  Pressure ranges: 0-15 to 0-10,000 psi also 0-30" H_2O and 0-30" Hg vacuum

- Mercury-actuated armored capillary temperature-sensing element available with plain bulb, union connection or union connection with separable socket.

  Temperature ranges available from—40°F. to 1000°F.

WRITE TODAY for Bulletin 978-B containing complete information.

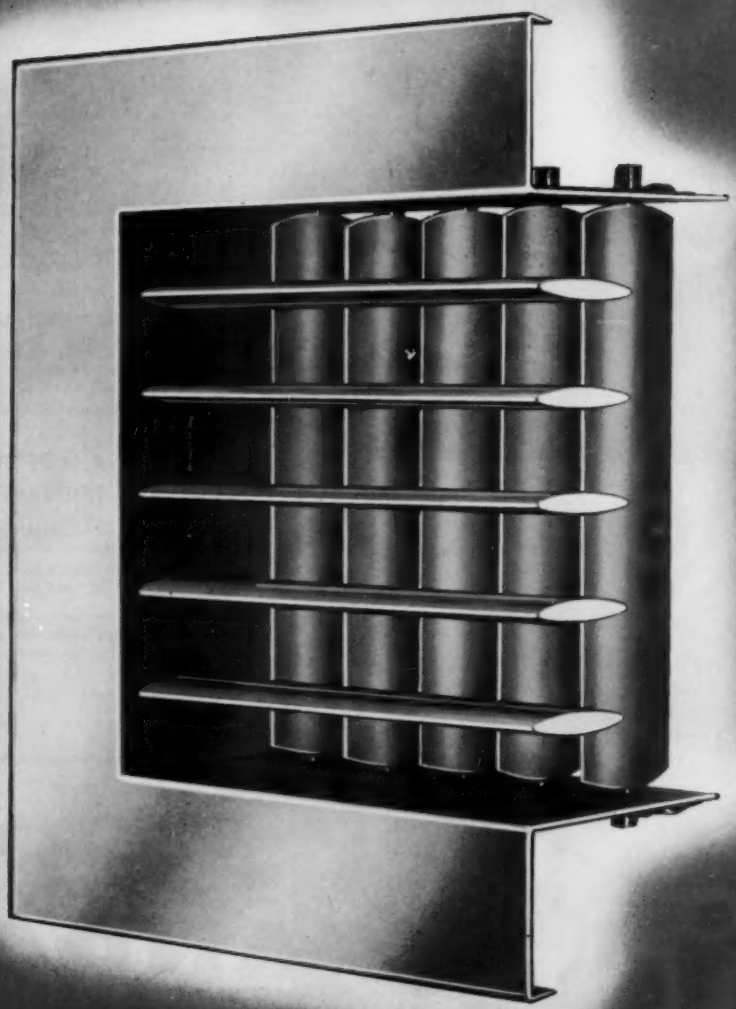
CASH STANDARD

A. W. CASH COMPANY, P. O. Box 551, Decatur, Illinois

Pressure, Hydraulic, Temperature, Process and Combustion Controls

ROOM AIR DISTRIBUTION . . .

TITUS ELIMINATES INSTALLING



IS NOT COMPLICATED

50% OF GRILLE ENGINEERING & ADJUSTMENT PROBLEMS

NEW MORE AIR CONTROL BUILT-IN

By engineering MORE AIR CONTROL per square inch into each diffuser and grille . . . *right at the factory* . . . Titus simplifies all phases of grille *specification, selection, installation* and *adjustment.* Eliminates any necessity for special factory schooling or instruction at the contracting, engineering or tradesman level. Any workman can install a Titus grille without unbalancing the whole expensive system.

NEW MORE SIMPLE INSTALLATION

Install grille in 2 easy steps. (1) Fasten grille in place with screws. (2) Adjust louvers for correct air patterns. Titus *makes it easy, makes it simple* to obtain correct air patterns . . . patterns that give *maximum room comfort . . . from any air conditioning system.*

NEW MORE FLEXIBILITY OF ADJUSTMENT

Most important . . . any miscalculations that have crept in during the installation period may be simply and easily corrected by quick adjustment of streamlined Airfoil louvers. ADJUSTING IS DONE *WITHOUT* REMOVING GRILLES FROM WALLS. COSTLY TIME-CONSUMING "CALL BACKS" ARE ELIMINATED.

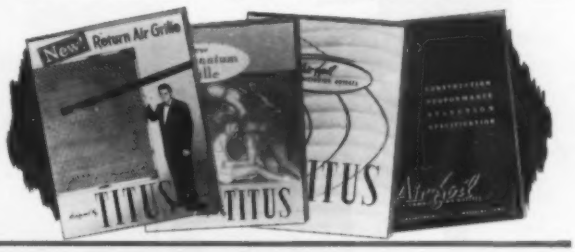
NEW SIMPLIFIED, FOOL PROOF DESIGN

All Titus grilles and diffusers are built under the most rigid, precision-controlled standards. They give finest air diffusing performance. Air control cannot be lost at the installation level. Titus grilles are so carefully constructed it is almost impossible to have anything but correct diffusion of air . . . no matter who installs or adjusts them.

SETS PERFORMANCE STANDARD FOR ENTIRE AIR CONDITIONING SYSTEM

Directs air where it is needed. Keeps uniform temperatures throughout room. Eliminates old-fashioned drafts . . . low level stratification. Truly controls comfort . . . *at the room level* . . . THE ONLY AREA WHERE THE UNIT'S ENTIRE HEATING OR COOLING PERFORMANCE IS JUDGED.

FREE CATALOGS



Get information on the complete line of Titus grilles now.
Order actual samples. Look at them. Hold them in your hands. Test them. See for yourself why Titus can save you money. Can give you better air diffusion performance . . . in every type of building where air conditioning is used.

TITUS MANUFACTURING CORP., WATERLOO, IOWA

Gentlemen: I wish to simplify my grille installation problems and to lower my grille installation costs. Please send me complete information on the following Titus grilles.

☐ Supply Grilles & Registers ☐ Return Air Grilles ☐ Volume Controllers
☐ Frames and Accessories ☐ Gymnasium Grilles

Name _____

Address _____

City _____ State _____

SPECIFY

alco solenoid valves

A SOUND INVESTMENT, ALWAYS QUIET

THEY ASSURE DEPENDABLE REFRIGERANT CONTROL WITH LITTLE MAINTENANCE:

- Tight seating for positive shut-off
- Moisture-proof coils to prevent burn-out
- Easy servicing without breaking connections

Add these advantages to *your* refrigeration systems. ALCO—the most complete line for all types of refrigerant service: liquid, suction or hot gas discharge . . . brine, water, steam and air.

SEE YOUR ALCO WHOLESALER

Write for Condensed Catalog 20 and technical bulletins 173 and 182

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

6650

ENGINEERED...for service...for life

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

A new high in **HIGH VELOCITY**

The photograph above shows main banking floor of the First National Bank in Dallas. Note how straight line All-Air High Velocity units blend perfectly into the architectural design. *See next page for detail.*

The All-Air High Velocity system also provides draftless comfort throughout the bank as well as in the second floor executive offices (shown at left). *See next page for detail.*

Architect: George L. Dahl

Consulting Engineer:
Landauer, Guerrero & Shafer

Contractor:
C. Wallace Plumbing Co.

Main banking floor

Sketch of photograph on preceding page shows the installation of twenty-four Anemostat 36-inch HPSL-100 High Velocity units, each supplying 200 cfm. A total of 4800 cfm is delivered to the main banking floor.

These pages illustrate the use of the Anemostat All-Air High Velocity distribution system in a modern air-conditioned bank. Anemostat High Velocity units are also being used throughout the country in many other applications such as hospitals, schools, department stores, office buildings and plants. • Here are some of the important architectural and engineering advantages of the Anemostat All-Air High Velocity distribution system. It can be used with smaller than conventional ducts. It can be installed faster and at less cost. It requires no coils, thus eliminates leakage, clogging and odors. Anemostat round, square and straight line diffusers with high velocity units are adaptable to a wide variety of architectural designs.

For latest data on Anemostat All-Air High Velocity units, write on your business letterhead for new Selection Manual 50.

Second floor executive offices

Diagrammatic ceiling view of offices on preceding page. This shows the installation of five Anemostat HPCM-1-100 High Velocity units, each supplying 125 cfm.

ANEMOSTAT®

DRAFTLESS *Aspirating* **AIR DIFFUSERS**

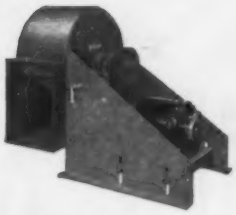
ANEMOSTAT CORPORATION OF AMERICA

10 East 39th Street, New York 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

nyb



Nos. 76 and 91
Belted
Junior Fan

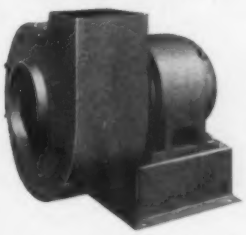
GENERAL PURPOSE FANS

Recommended for their ease of installation,

low maintenance cost and space saving features.

Portable, self-contained units of medium capacities for low pressure industrial and ventilating applications. Designed particularly for use with duct systems.

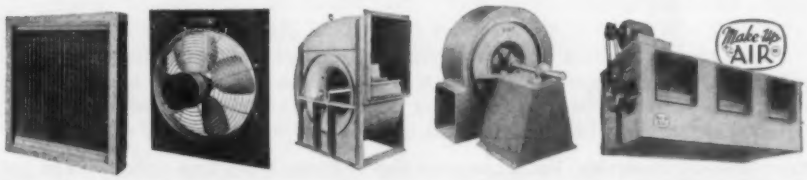
General Purpose Fans are made in three types and eight basic sizes with capacities from 1200 to 19,000 cfm. (Junior fans in five sizes from 160 to 4100 cfm). These include both direct connected and belt driven models.



No. 10 G. I. Industrial Fan

with manganese bronze wheel, spark proof and acid resistant. For use in hazardous locations where explosive air mixtures are to be handled, and for handling hot gases and conveying materials in process. Two arrangements, two types of wheels. All fans reversible. Speeds up to 4500 rpm. For temperatures up to 350°.

nyb products have 65 years of manufacturing experience and engineering knowledge built into them. All ***nyb*** products are laboratory tested, accurately rated and fully guaranteed in strict accordance with standard test codes.



When working on your air handling problems, consult the *nyb* representative nearest you in our nationwide service or write for bulletins.

CERTIFIED RATINGS
AUTHORIZED BY NAFM

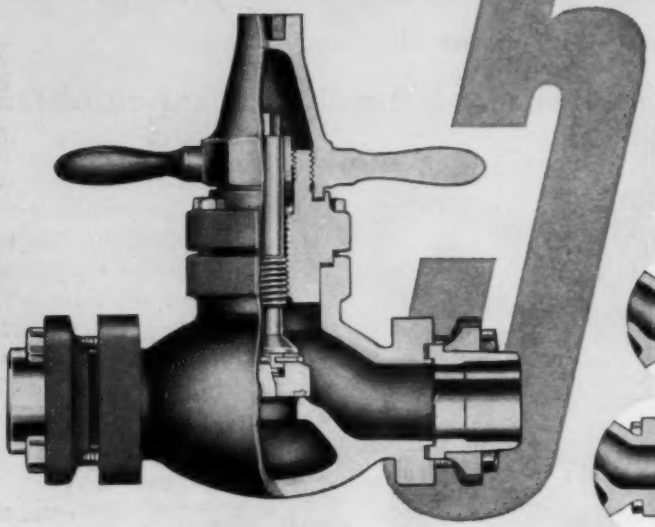
nyb **THE NEW YORK BLOWER COMPANY**

SALES OFFICES • 3159 SOUTH SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA

FIVE TYPES OF CONNECTIONS IN HENRY

SEMI-STEEL WING CAP VALVES



F.P.T.
In Valve Body
½" thru 2½"

O.D. Solder
Brass Adapter
and Steel Flange
1⅜" thru 5⅛"

Steel Butt Weld Adapter
and Steel Flange
1¼" thru 5"

One Piece F.P.T. Flange
1¼" thru 6"

One Piece Slip-on Weld Flange
1¼" thru 6"

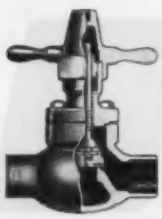
MAKE INSTALLATION EASY

Specify Henry Wing Cap Valves with their wide choice of end connections and your installation costs will always be low.

For example, steel pipe can be screwed directly into the valve body on sizes thru 2½", or it can be screwed into one piece F.P.T. flanges on sizes 1¼" thru 6". It can also be butt welded to separate steel adapters with companion flanges or used with one piece slip-on weld flanges in the same larger size range. If copper pipe is used, separate brass O.D. solder adapters with companion flanges permit soldering or brazing.

BRONZE BODY VALVES all have O.D. solder connections.

Henry offers you other features as well: Full capacity and unrestricted flow—patented self-aligning stem disc that will not rotate—resilient packing—back-seating design which permits repacking under pressure— a gasketed wing cap with socket which, when inverted, can be used to operate valve.



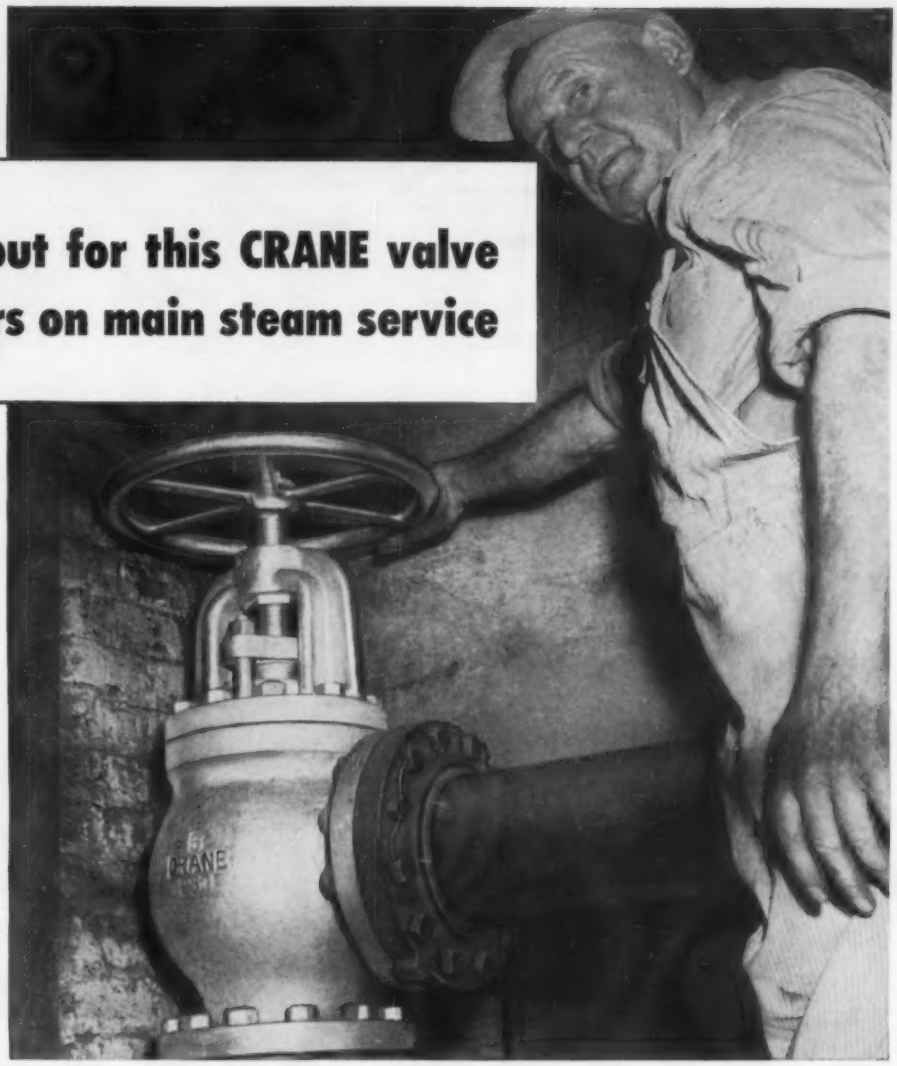
BRONZE ALLOY WING CAP VALVES

Made of bronze alloy to meet government specifications. Compact design —relatively light weight. Bolted bonnet construction and heavy wall bodies for maximum strength and safety. O.D. solder connections machined in valve body. Size range: ⅞" thru 4⅛" globe type; ⅞" thru 3⅛" angle type.

Your favorite wholesaler has a complete line of Henry Wing Cap Valves or can get them for you.

HENRY VALVE CO.
MELROSE PARK, ILLINOIS
(Chicago Suburb)
Cable: Hevalco, Melrose Park, Illinois
Valves, Driers, Strainers, Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications.

No time out for this CRANE valve in 40 years on main steam service



THE CASE HISTORY—Two Crane 250-pound iron body angle valves—6-inch (shown) and 5-inch size—scored this exceptional service record.

They were installed in 1915 on the main steam leads from boilers in the plant at Delavan, Wis., now occupied by The George W. Borg Corporation. In 40 years' uninterrupted service these Crane valves never failed to operate properly nor caused a shutdown. With but routine maintenance, they opened fully and were seated tight with ease under infrequent operation. Working pressure of boilers was originally 150 psi.—later reduced to 75 psi. This year, both valves were retired. The new replacements are Crane quality valves, of course.

Crane iron valves in particular need no introduction to thrifty buyers. In all grades, Crane iron castings generously exceed the requirements of equivalent A.S.T.M. specifications. Crane Ferrosteel, for instance, used in 250-pound valves is 35% stronger than ordinary cast iron.

In any pressure class, you'll find Crane quality outstanding. Choose from complete lines of gates, globes, angles and checks. Your Crane Representative can give valuable help in specifying and ordering.

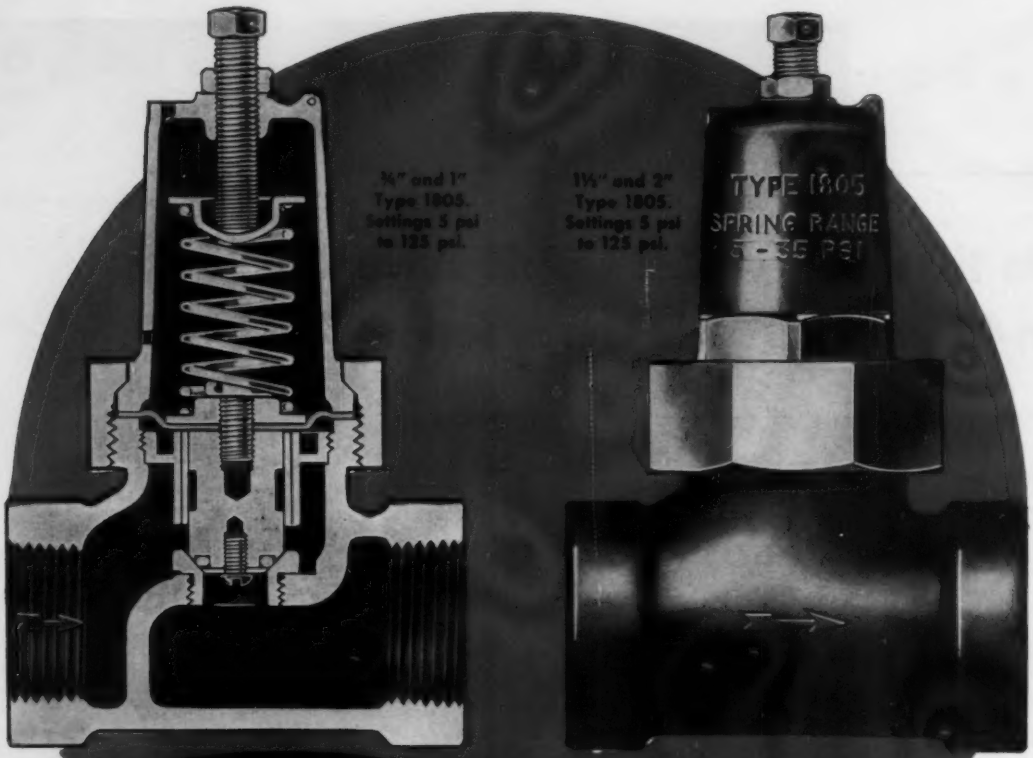
Crane Co., General Offices, Chicago 5, Ill. Branches and Wholesalers serving all industrial areas.

CRANE CO.

for the THRIFTY BUYER

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955



FISHER®

TYPE

1805

LARGE CAPACITY

RELIEF VALVES

The Fisher Type 1805 is an *economical* small self-contained large capacity relief valve for applications where it is necessary to provide protection from over-pressuring a downstream system.

It is suitable for low pressure gas, air, water or vapor lines—and for temperatures not in excess of 150° F. Single seated—soft seat "O" ring construction for tight shut-off.

Sizes: ¾", 1", 1½" and 2".

Relief pressure ranges: 5 psi to 125 psi.

FISHER GOVERNOR COMPANY • MARSHALLTOWN, IOWA

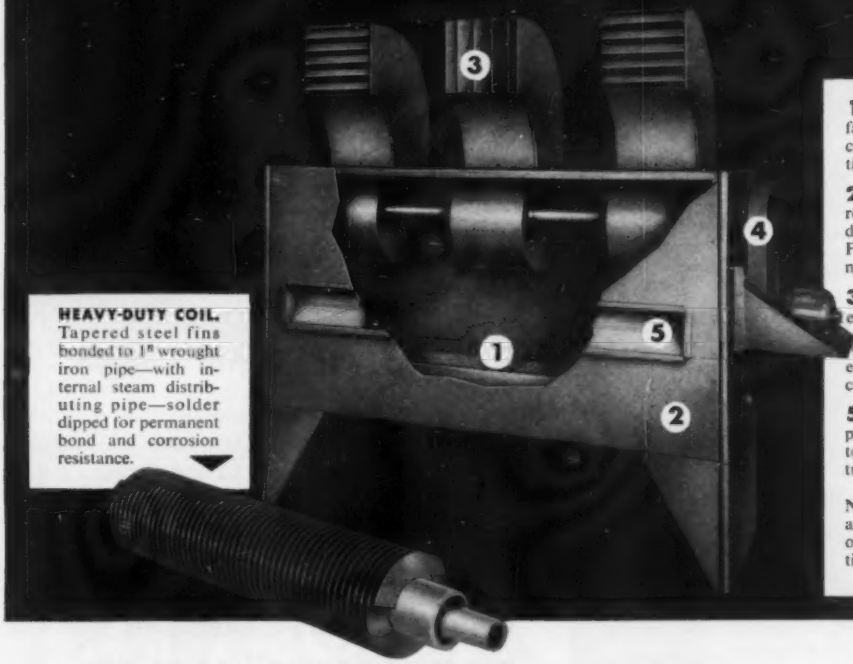
WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

FISHER

Our 75th ANNIVERSARY

Fact:

Rugged Westinghouse Industrial Heaters available in 24 Sizes . . . 8 Coil Selections . . . 150 Ratings from 100,000 to 2,500,000 BTU/hr . . . 2,000 to 25,000 CFM each



HEAVY-DUTY COIL. Tapered steel fins bonded to 1" wrought iron pipe—with internal steam distributing pipe—solder dipped for permanent bond and corrosion resistance.

1. Proven, Westinghouse-manufactured, extended surface heating coils good for continuous operation up to 200 psig.

2. Die-formed casings with rounded corners eliminate accidents and dirt catching pockets. Front and back panels easily removable.

3. Multiple louvered outlets for efficient distribution of heated air.

4. Self-aligning, grease-lubricated ball bearings mounted outside casing, readily serviceable.

5. Face and by-pass dampers permit continuous air circulation to maintain uniform temperatures.

NOTE: Louver type mixing box accessory permits introduction of fresh air for make-up and ventilation, with or without filters.

Solve your space heating problems with Westinghouse-Sturtevant Industrial Heaters. Eliminate cold, drafty conditions caused by excessive cold infiltration through leakage or exhaust.

Two Types With Wide Applications:

GENERAL PURPOSE HEATER . . . For manufacturing areas, warehouses, garages, commercial buildings—with standard non-ferrous heating coils.

HEAVY-DUTY HEATER . . . For continuous-duty high-pressure systems, or industrial process work—with wrought iron heating coils.

The compact packaged engineering of every Westinghouse-Sturtevant Industrial Heater provides units for mounting on floor, walls, or suspended from ceilings. In short, they can be placed where they will do the most good, and can be relocated to meet any change in plant layout.

Every unit is backed with a Westinghouse exclusive—*one warranty*. Only Westinghouse makes all principal components—Fans, Heating Coils, and Motors. You can get unit engineering and single equipment responsibility.

MORE FACTS? To find out how to solve your particular heating problem, call your Westinghouse-Sturtevant Sales Engineer . . . he is the "Man With The Facts" on heating, air handling, and electronic air cleaning . . . or fill in coupon below.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S **Westinghouse**

J-80427

Westinghouse Electric Corp.
Sturtevant Division, Dept. 5-K
Hyde Park, Boston 36, Mass.

Please send more information on your Industrial Heaters.

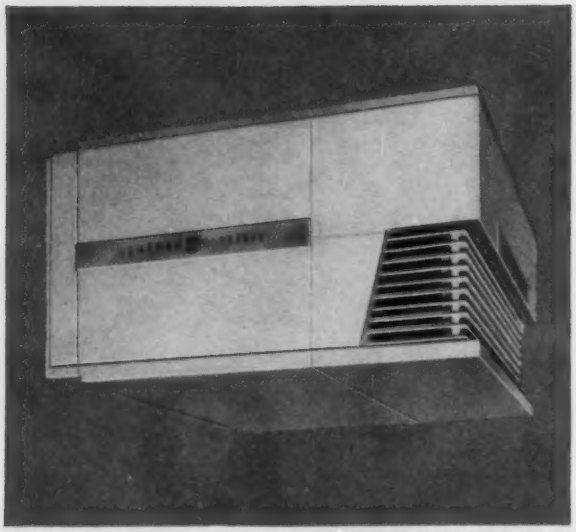
NAME AND TITLE .....

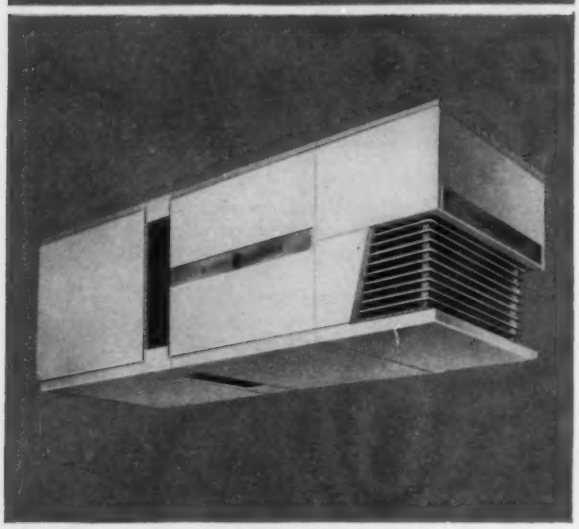
COMPANY .....

CITY .....STATE.....

GENERAL ELECTRIC ANNOUNCES

CEILING-MOUNTED PACKAGED AIR CONDITIONERS





All-in-one unit needs no floor space... gives important design advantages

These compact G-E units enable you to plan more efficient use of space. They don't use a foot of floor space—instead, are attached to the ceiling or mounted on a shelf. And they're compact, self-contained packages—with motor, compressor and condenser all sealed inside the unit.

Air-Cooled or Water-Cooled

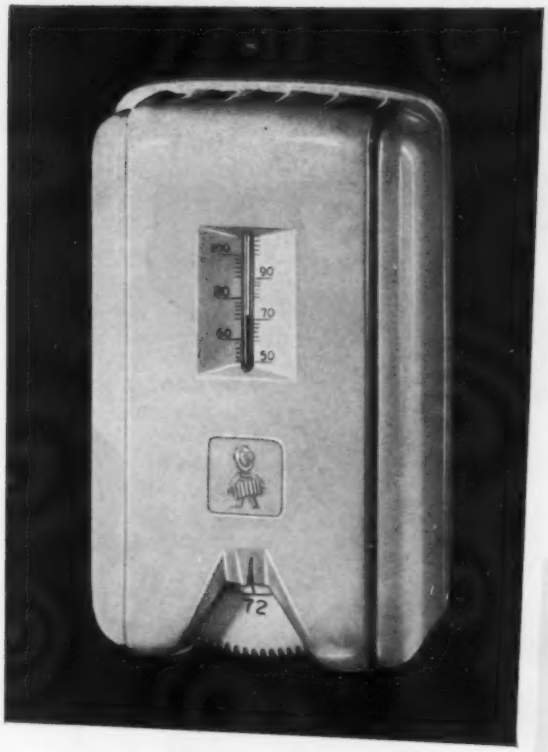
Where water is a serious problem, G-E air-cooled units, in 3 and 5 ton sizes, are an ideal answer... use no water, require only air and electricity. G-E water-cooled units are available in 3, 5 and 7½ ton sizes. All units may be equipped with coils for winter heating.

Only complete packaged air conditioning line on the market—fills every need

Now, you can specify from one manufacturer the right air conditioning units to fit your plans. G-E floor-mounted models—in 3 to 15 ton capacities—are as well suited for modern functional design as G-E ceiling-mounted packages. For free booklet, "What Every Businessman Should Know About Weather Reflex", write General Electric Company, Commercial and Industrial Air Conditioning Department, Bloomfield, New Jersey.

Progress Is Our Most Important Product

GENERAL ELECTRIC



This new Fulton Sylphon Room Thermostat, No. 801 Series, operates within plus or minus ½° of set point. The compact, sturdy design employs a powerful Sylphon Bellows thermostatic unit to provide accurate response to the slightest change in room temperature.

Cable or blanket type panels, wall heaters, suspended unit heaters and portable heaters are accurately controlled by this heavy duty, line voltage type unit. The No. 801 Thermostat can be used also for direct line voltage control of stokers, oil burners and circulating pumps. Use the convenient coupon for complete details.

NEW ROOM THERMOSTAT No. 801

• For Electric Heating Units • Small As A Switch Plate And Extends Out Only 1⅞" • Rating: 20 amps. (non-inductive load) at 125-250 V.A.C.; ¾ HP at 115 V.A.C. and 1½ HP at 230 V.A.C. • Easily Installed • UL Approved

FROM FULTON SYLPHON TEMPERATURE REGULATOR HEADQUARTERS, U.S.A.

Robertshaw-Fulton
CONTROLS COMPANY
FULTON SYLPHON DIVISION

FULTON SYLPHON DIVISION
Knoxville 1, Tennessee

Please send me a copy of the new Room Thermostat Bulletin 801.

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Company_____

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KENNARD Air Conditioning Equipment Assists

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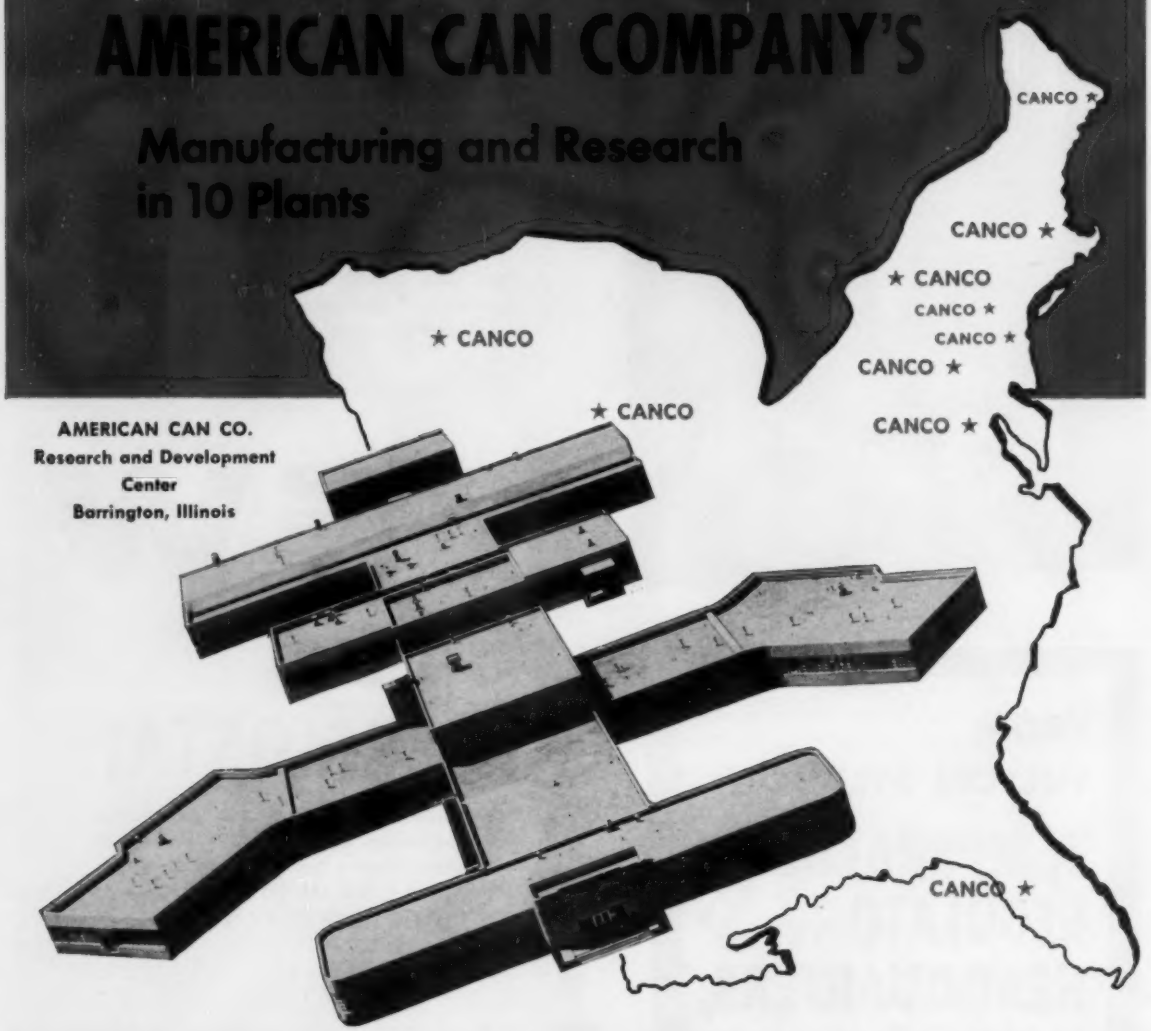
AMERICAN CAN COMPANY'S

Manufacturing and Research in 10 Plants



This modern scientific center—which has been two decades in planning—has been especially designed, engineered and equipped to develop and perfect the containers of tomorrow.

Kennard Corporation is most pleased to have been able to supply Kennard Air Conditioning products again for another American Can Company plant. Twelve Air Conditioning Units and ten Heating and Ventilating Units went into this latest and finest Canco Research and Development Center at Barrington, Illinois.

KENNARD CORPORATION
1817 HANLEY RD. • ST. LOUIS 17, MO.

Representatives in All Principal Cities

Careful Selection of Representation Is Most Important

The air conditioning industry has been one of America's fastest growing industries, and perhaps one of the most difficult in function and operation.

Air conditioning, in its overall application, touches on nearly every phase of American life and activity. This being true, it is necessary that the men who represent a manufacturer of air conditioning products must be thoroughly trained and experienced. It is not enough that they be only trained in estimating and pricing the job to be done. It is of vital importance that they should be able to assist the architect, consulting engineer and the contractor with proper selection of their own and associated parts to give the best overall performance for the entire air conditioning job.

Kennard representatives are selected to provide these services over the years. As a nation wide organization, they reflect this and are capable helpers on any air conditioning problem that may be their lot to work on. Whether it be a job in being, a job intended, or merely a friendly consultation, call and rely on a Kennard representative.

Practical Research Assures Sound Engineering

Every Kennard product has undergone much testing in our own laboratories. Every phase of use and efficiency has been carefully analyzed and checked.

With the greater need and demand for human comfort and exacting requirements for controlled air conditions on industrial application, Kennard has proven their ability to satisfy and fulfill these uses in many outstanding successful applications of normal or unusual nature

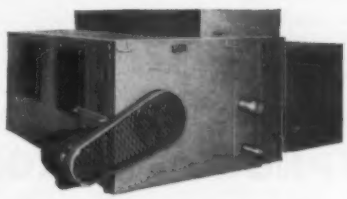
CONSISTENTLY RELIABLE

KENNARD *Engineered* AIR CONDITIONING EQUIPMENT

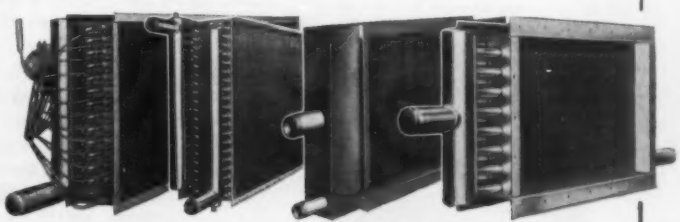
AIR CONDITIONING BLOWER UNITS

13 sizes. 300 to 21,600 CFM. Horizontal or Vertical. Catalog No. AC.

HEATING AND VENTILATING UNITS



Air Volumes 300 to 28,800 CFM. Catalog No. HV.

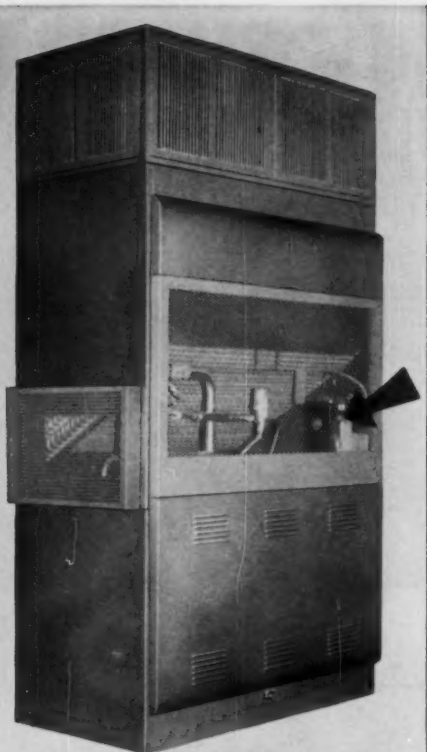


AIR CONDITIONING AND HEATING COILS

Direct Expansion, Water, Steam Distributing Tube, Standard Steam Coils. Sizes up to 48" wide x 132" long. Catalogs No. CC and HC.

Write for name of nearest representative and catalogs needed.

KENNARD CORP.
1817 S. HANLEY ROAD
ST. LOUIS 17, MO.

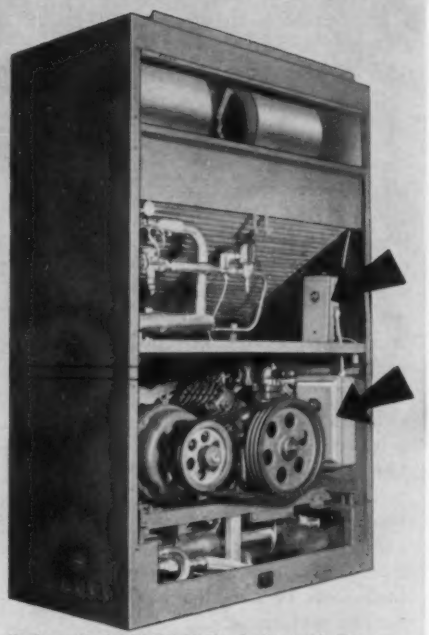


Typhoon Model 214SC 20 Hp, Package Air Conditioner which is equipped with Allen-Bradley Bulletin 709 motor starter and controls.

Bulletin 836
Pressure Switch

Bulletin 837
Temp. Control

Special Control
Panel



Typhoon Model 164SC 15 Hp, Package Air Conditioner which is equipped with Allen-Bradley Bulletin 709 solenoid starters.

TYPHOON AIR CONDITIONERS
use Allen-Bradley Trouble Free Motor Controls

Allen-Bradley Bulletin 709 solenoid starters are available in 8 sizes up to 300 hp, 220 volts; 600 hp, 440-550 volts.

Manufacturers—and especially ultimate users—cannot tolerate trouble in their air-conditioning and refrigeration controls. Actual experience under all operating conditions has proved Allen-Bradley controls are good for millions of trouble free operations. That's the kind of reliability that has established the world-wide Allen-Bradley reputation for QUALITY.

Allen-Bradley reliability is due to the SIMPLICITY of design, QUALITY of workmanship and materials, and THINKING in terms of the user of the apparatus.

When you obtain the combination of these three factors in motor controls, you don't have to worry. QUALITY performance is assured. Specify Allen-Bradley.

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1335 S. First St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

A-B Quality

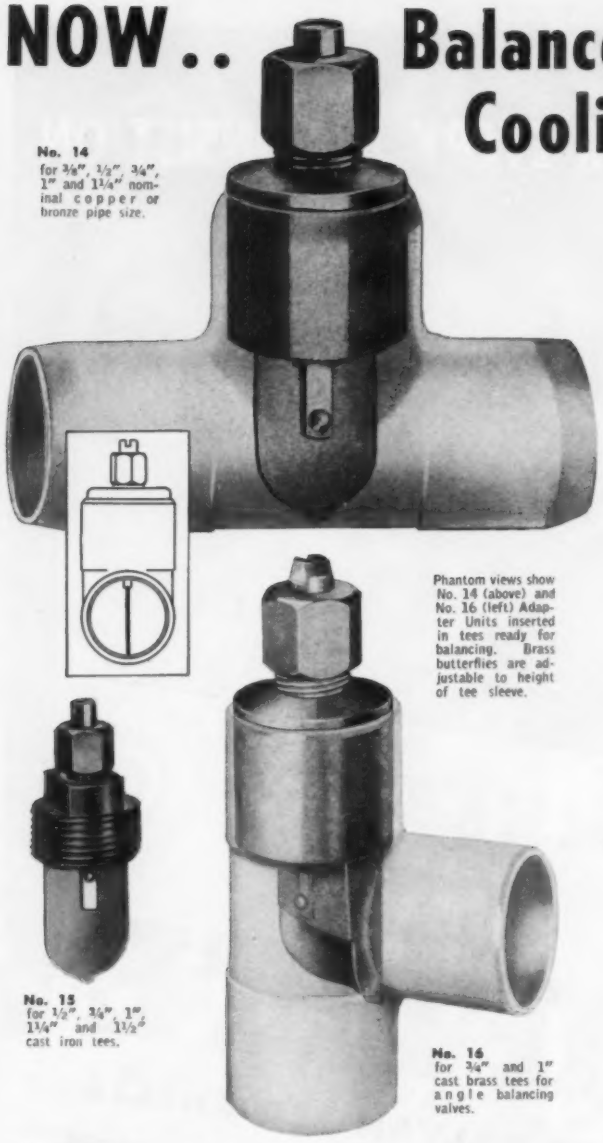
The Sign of QUALITY Motor Control

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

QUALITY

NOW.. Balanced Heating and Cooling Systems with

MAID-O'-MIST adapter units



No. 14
for 3/8", 1/2", 3/4", 1" and 1 1/4" nominal copper or bronze pipe size.

Phantom views show No. 14 (above) and No. 16 (left) Adapter Units inserted in tees ready for balancing. Brass butterflies are adjustable to height of tee sleeve.

No. 15
for 1/2", 3/4", 1", 1 1/4" and 1 1/2" cast iron tees.

No. 16
for 3/4" and 1" cast brass tees for angle balancing valves.

Easy to install without advance planning . . . Make any standard tee an efficient balancing valve!

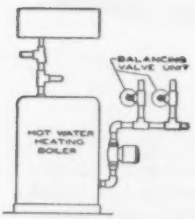
Maid-O'-Mist Adapter Units offer an easy way to make your own valves for balancing old or new water systems for heating or cooling . . . and to make them at low cost. These units make costly stocks of complete balancing fittings no longer necessary.

Permit free flow

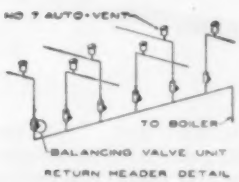
Precision-made Maid-O'-Mist Adapters permit free flow of water through the tee. Since there is no inside reduction of pipe diameter, water restriction is limited only to the balancing required. This advantage, plus low cost, permits use of additional balancing in any system without elaborate planning.

Easy to install and adjust

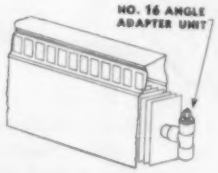
Maid-O'-Mist adapters Nos. 14 and 15 may be inserted in the side outlet of a tee of the same pipe size to complete a straightway balancing valve. No. 16 may be inserted in the run of a cast brass tee to complete an angle balancing valve. These adapter units are quickly soldered or sweat-fitted into regular copper, bronze or brass tees or threaded into cast iron tees. A simple balancing adjustment requires only a screwdriver to adjust. Units are made of brass with packed stem construction. Available in sizes shown.



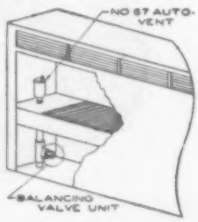
For return header



For radiant header



For baseboard radiators



For convector radiators

See your jobber for prices and other information or write for catalog direct to . . .

MAID-O'-MIST Inc.
HEATING SPECIALTIES

AUTOMATIC HUMIDIFIERS . . . . . AUTO-VENTS
WATER LINE CONTROLS . HEATING SPECIALTIES

MAID-O'-MIST, Inc.

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FOR *EVERY* JOB, INSIST ON

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COP-R-LOY® GALVANIZED SHEETS

Wheeling

Wheeling also manufactures a complete line of Galvanized Furnace Pipe, snap lock or closed seam Perimeter Heating or Air Conditioning Pipe, and accessories.

Make every job you do turn out *just right* — insist on Wheeling SOFTITE Galvanized Sheets. Here's as workable a sheet as you'll find anywhere ductile and amazingly tight coated.

And no matter how you fabricate Wheeling SOFTITE, the coating won't crack, won't flake. In fact, the coating will take anything the base metal will.

Put SOFTITE to any test. See why the demand for SOFTITE has forced Wheeling to triple its production facilities in 1955.

Try Wheeling SOFTITE once . . . you'll see why actual users call Wheeling SOFTITE the best galvanized sheet yet produced.

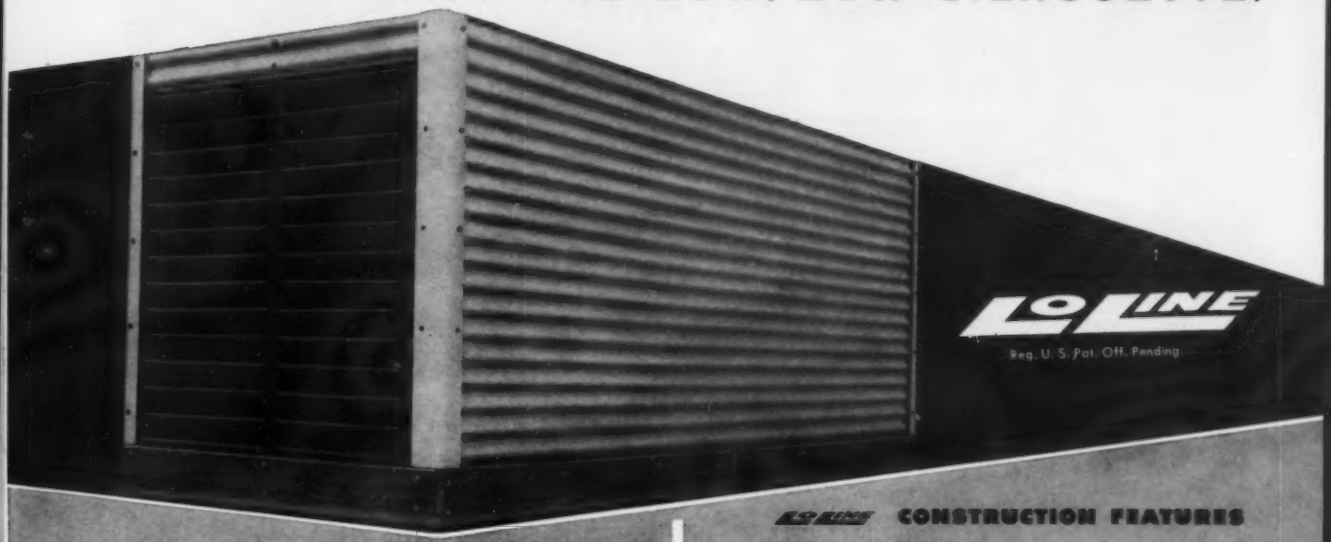
For details call the nearest Wheeling warehouse or office.

Galvanized steel does it better..
SOFTITE does it best!

WHEELING CORRUGATING COMPANY, WHEELING, WEST VIRGINIA

For your convenience, warehouse stock immediately available at these locations: Boston, Buffalo, Chicago, Columbus, Detroit, Kansas City, Louisville, Minneapolis, New Orleans, New York, Philadelphia, Richmond, St. Louis. Sales Offices: Atlanta, Houston.

THE ALL-NEW PRITCHARD COOLING TOWER— WITH THE LOW, LOW SILHOUETTE!



This new Pritchard LoLine Tower solves two problems for the architect, the building owner and the contractor.

First it meets the trend toward suburban building which has made longer, lower-lined buildings possible. Second, it answers the demands of metropolitan buildings where cooling towers must still be mounted on the roof, by providing a low silhouette which can be easily concealed.

Most important, Pritchard LoLine Towers combine proved new and old features into an efficient, economical cooling unit. This should be no surprise to the many thousands of satisfied Pritchard cooling tower users who have long known that Pritchard is "Industry's Partner for Progress!"

LOLINE CONSTRUCTION FEATURES

FRAMEWORK. Select Heart redwood or better. Surfaced, machine fabricated for precision fit. Each member strongly braced with special connectors for economy and longer life.

AIR INLET LOUVERS. Two sets, one on each side of tower. Each set has slip-fit louvers of cement asbestos board, individually removable from machined slots for easy accessibility to tower.

CASING on the Pritchard LoLine Tower has been carefully designed to make the tower attractive from an architectural point of view. This has been done through the use of horizontally installed, corrugated, asbestos cement board panels and corner rolls which further add to the low appearance. Watertight construction is assured. The pre-fabricated panels are securely bolted to the framework.

MECHANICAL EQUIPMENT. Drive design is simple: V-belt or reduction gear drive supported by rigid hot-dipped galvanized structural members. Fan shaft is stainless steel with self-aligning bearings. Fan, equipped with aluminum blades, is carefully machined and balanced.

ACCESSORIES. A complete line of accessories including ladders, louver screens, fan discharge screens, and basin accessories are available. A new optional feature — internal water supply piping terminating in a flanged connection at the base of the tower — eliminates unsightly exterior water supply piping.

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COOLING TOWERS
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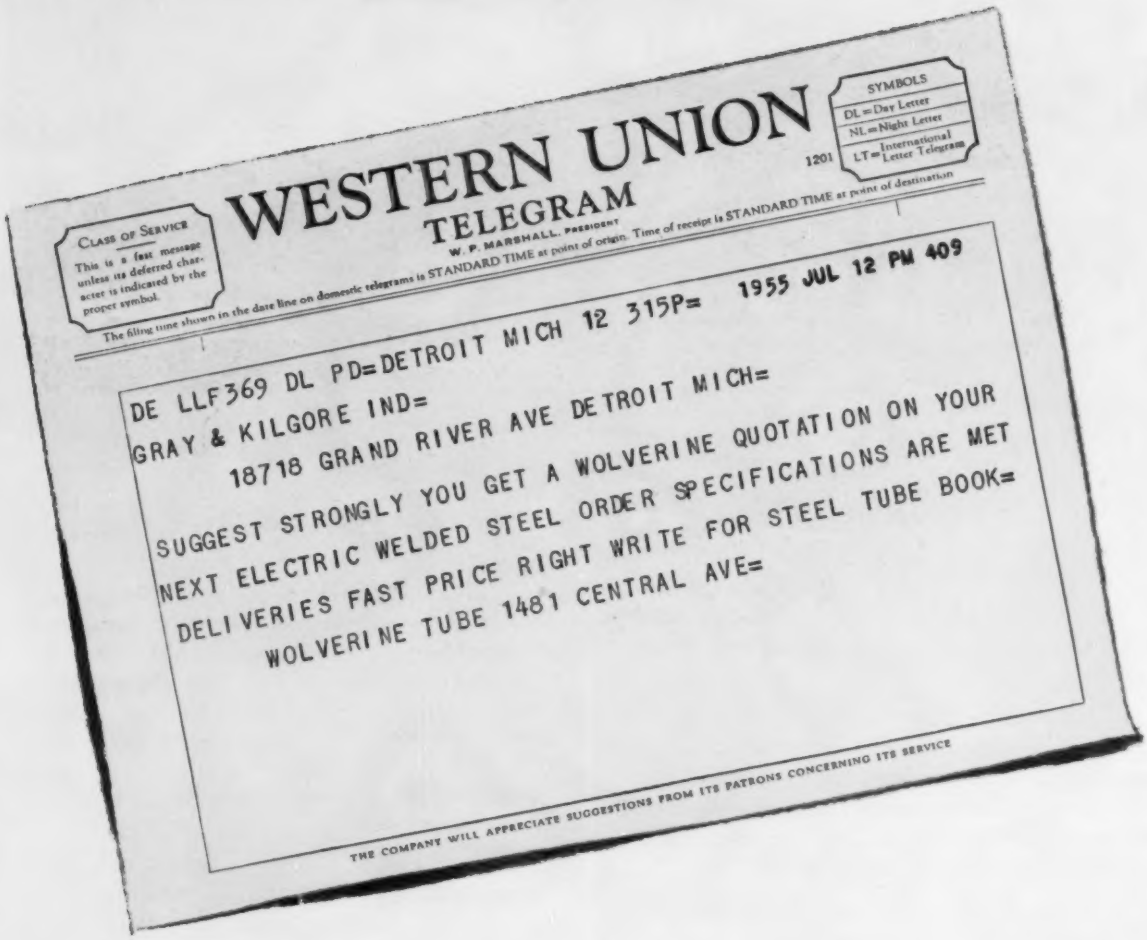

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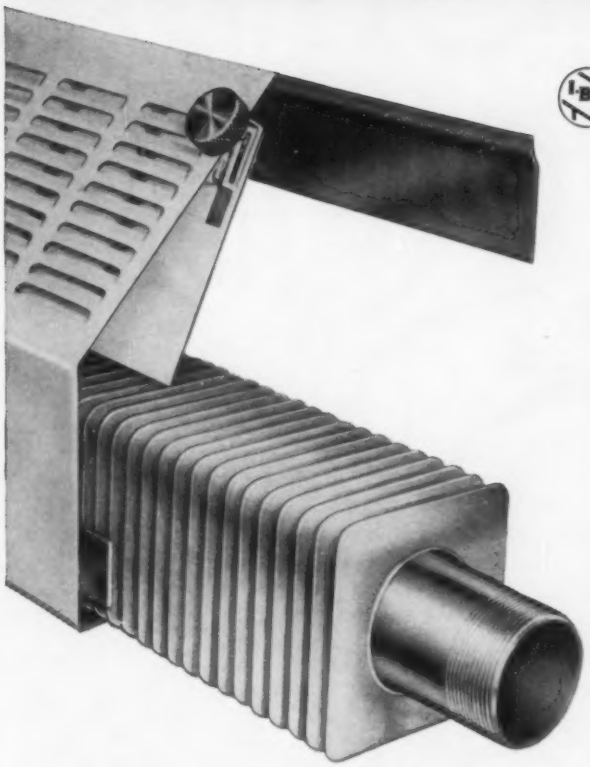

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When you want the best in unit heating...

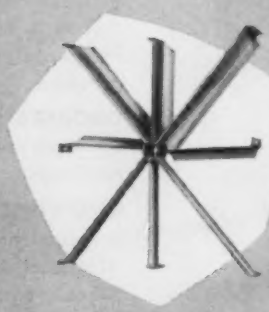
Look for the name MODINE

Like so many well-known, pioneer names . . . Frigidaire, Victrola, Kodak . . . "Modine" is commonly used as a descriptive word to identify all makes of steam and hot water unit heaters. But — if it doesn't carry the MODINE nameplate, *it is not* a Modine Unit Heater.

Only unit heaters designed and built by Modine give you all the performance and operating advantages which have made Modine the first name in unit heating for over a quarter century. And continuing research and development are your assurance that Modines will always be your best buy for heating comfort and economy.

More comfort per fuel dollar

Discharge air temperatures of 110° to 120°F are correctly related to air velocities, assuring perfect heating comfort plus lower fuel costs.



Greater heat throw

No one but Modine provides a built-in velocity generator that effectively steps up heat throw . . . assures positive heat penetration of cold air strata near floor.

A model for every need

Modine horizontal delivery models for steam and hot water are built in two distinct types (blow-through and draw-through) and 36 different capacities. A unit for every application.

Sturdy built-in fan guard

Safety fan guard of steel rod stock offers constant protection. Also serves as resilient motor mount, absorbing and dissipating fan vibration.

Modine Vertical Unit Heaters are offered in 26 different models, each with choice of 4 types of air deflectors. New light weight cuts installation costs.

SU-1286

Want the complete story?

For details on why Modine offers you the best in unit heating . . . more value, less trouble — contact the representative listed in your classified phone book. Or, ask for Catalog 155. Write to Modine Mfg. Co., 1509 De-Koven Ave., Racine, Wisconsin.

Modine UNIT HEATERS

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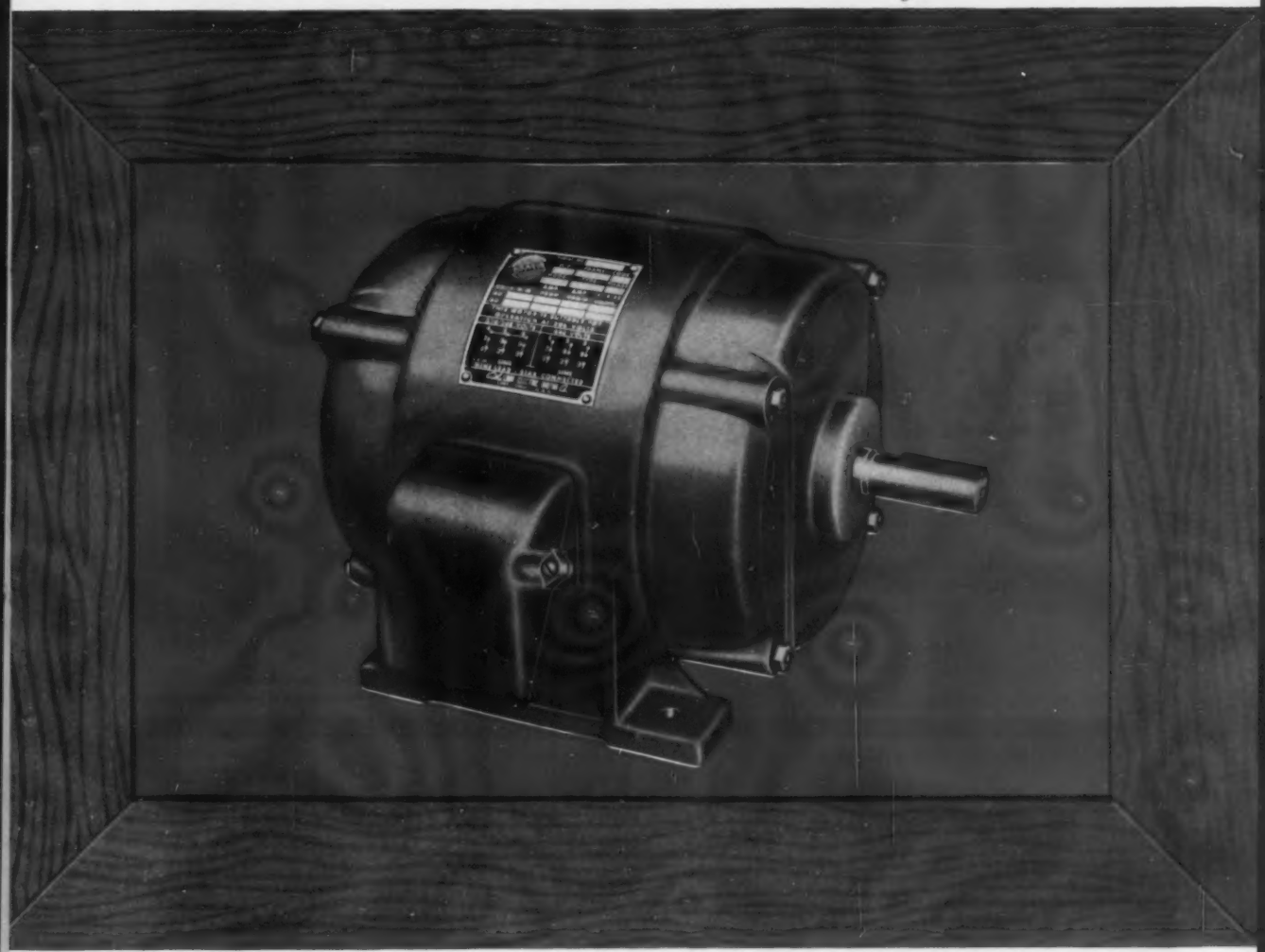
A New Approach to Perfection



LIMA

New NEMA Frame Sizes

No longer is it necessary for the designer to compromise motor power or performance to meet size and weight limitations!

Now, Lima has in production all ratings in new NEMA frame sizes 182, 184, 213 and 215—with the 254U through 326 frames following on an accelerated schedule.

If your application requires greater efficiency in a smaller size with less weight, better protection and longer service-free life . . . then these new Lima Motors have been designed for you! Get detailed information from your Lima Representative now. If he is not already calling on you, his name and address will be found in the following Trade Directories: *Thomas' Register, Mac Rae's Blue Book,* or *Conover-Mast Purchasing Directory.*

Of course, the former NEMA frame sizes 66 to 505 (⅓ to 150 H.P.), incorporating the latest advances in motor design, will remain in production.

THE LIMA ELECTRIC MOTOR COMPANY, 4979 Findlay Road Lima, Ohio

Representation throughout the U. S., Canada and abroad

FIRST . . . FOR MOTORS . . . DRIVES . . . SPEED REDUCERS

THE ONLY Matched

COOLING TOWERS and CONDENSERS

The Halstead & Mitchell Cooling Towers you select are *matched* by design to work with the famous Halstead & Mitchell water-cooled Condensers. You need no longer buy a high-efficiency cooling tower to work with a low-efficiency condenser (or *vice-versa*) . . . a long-life cooling tower to work with a short-life condenser (or *vice-versa*).

Remember that every cooling tower you sell is planned to work with a water-cooled condenser—then you'll see why America's leading manufacturers of air-conditioning and refrigeration equipment have swung to Halstead & Mitchell for their original equipment needs in both these components.

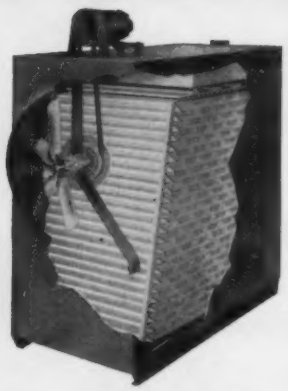
With cleanability you'll sell more. Why sell less?

20-Year Guarantee!

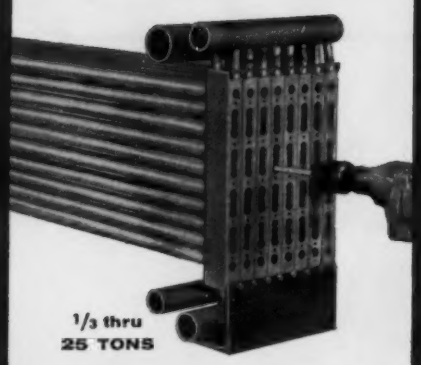
on the wetted deck surface against rotting or fungus attack

Only Halstead & Mitchell pressure-creosoting can provide a *guarantee* against immediate attack by fungus and marine parasites . . . or chemical deterioration from acids in water.

Added to this H&M exclusive are other major advantages. There's ultra-high efficiency in the gravity-type water distributing pan which eliminates extra pumping head required on spray type towers . . . and cuts down on water losses due to "atomizing" of water. And there's extra-long life in stainless steel fans . . . and sheet steel cabinets hydraulically painted with vinsynite, vinyl zinc and chlorinated rubber.



2 thru 120 TONS



1/3 thru 25 TONS

Lifetime Cleanability

The *mechanical* cleaning of H&M double-tube, counter-flow condensers means the simplest, least dangerous method of restoring new unit efficiency. Whether removing a heavy coating of sludge and scale, or a thin insulating film on the inner walls of the copper tubing, the mechanical cleaning tool restores heat transfer efficiency in a matter of minutes. The result is lowered discharge pressures . . . more heat carried off by cooling water . . . lower bills. *Only* the impurities are removed . . . the thickness of the copper wall remains intact, and the condenser gives extra years of peak service.

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Make no mistake about it . . . no matter how *small* your filter requirements . . . or *how large*, here is a completely new air filter development that can absolutely cut your clean air maintenance costs in half.

NO HEAVY TENSION OIL — Evans filters do not have a messy, sticky type of adhesive that is filthy to handle and difficult to clean. It is unnecessary and is forbidden in the use of Evans filters.

CLEAN WITH TAP WATER — Evans filters can be cleaned clean in minutes with nothing ever but tap water sprayed through an ordinary garden hose nozzle. They require no expensive fireproof room. No caustic cleaning solutions or agents. This eliminates all danger in the cleaning of Evans filters.

LIGHT WEIGHT CUT LABOR COSTS — Evans filters are all aluminum. Light to handle, to carry, to pick up. In spite of airtight fitting frames, Evans filters pull quickly and easily in and out of the frames. Take much less effort, less labor to handle. No latches . . . or lugs required.

REMEMBER: Initial costs for air cleaning equipment are not the big factors or controlling factors in the cost for clean air.

IT'S OPERATING COSTS THAT YOU MUST LIVE WITH AND THAT YOU MUST CONTROL.

EVANS FILTERS GIVE YOU THAT CONTROL. MAKE IT POSSIBLE FOR YOU TO SAVE 50% ON CLEAN AIR MAINTENANCE COSTS.

- ALL ALUMINUM
- EVERY PART PRECISION MADE
- HOLD UP TO 200% MORE DUST AND LINT WITHOUT HARMFUL RESTRICTION TO AIRFLOW
- GIVES LIFETIME SERVICE

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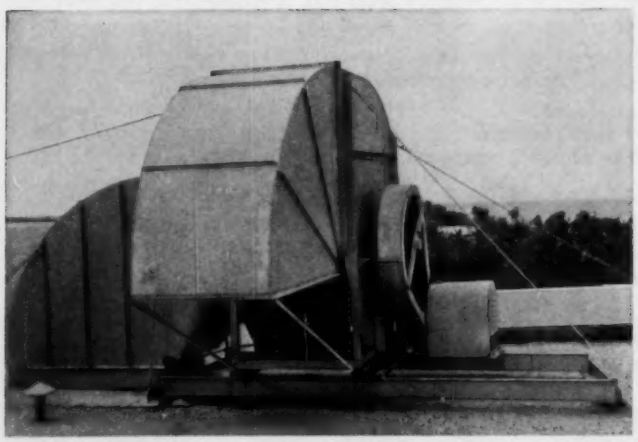
Lifelong AIR FILTERS

—ENJOYS VENTILATION BY "Buffalo"



ROOF EXHAUST FOR COOL COMFORT BELOW! One of the "Buffalo" Type BL Limit-Load Ventilating Fans on roof exhaust service at the Golden Gate Hotel. For details on these extremely quiet, efficient fans, write for Bulletin F-100.

Miami Beach's famed new Golden Gate Hotel and Cabana Club offers literally everything the vacationer could desire, including indoor climate to match the balmiest offshore breezes!

"Buffalo" Fans help to maintain these ideal air conditions, as they do in so many of the country's finest hotels, commercial and public buildings. Credit for this beautifully planned and executed project is well earned by: *Mechanical Contractors Supply, Inc., air conditioning contractors; Taylor Construction Corp., general contractors; Igor Polevitzky, architect; and Rader Engineering Co., mechanical engineers, all of Miami, Fla.*

For any air job you are planning, insure its finished performance by specifying "Buffalo", the fans with the famous "Q" Factor* built into them — the fans backed by 78 years of quality manufacture.

**The "Q" Factor — the built-in-Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

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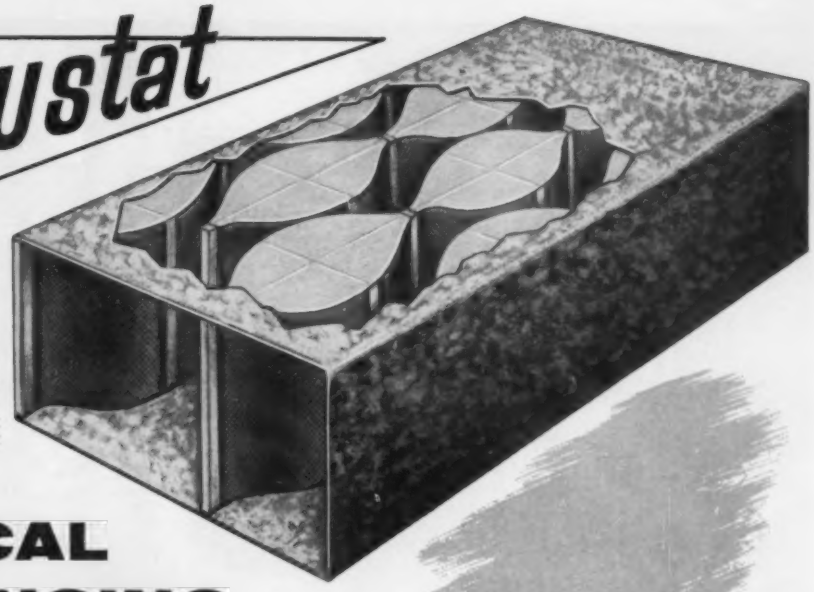
VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Aircoustat

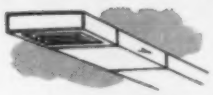


PRACTICAL SILENCING
for AIR CONDITIONING SYSTEMS

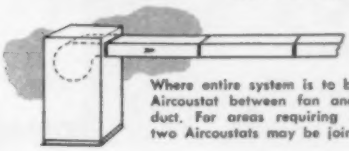
Aircoustat is a compact, *completely packaged* unit for silencing fan and air noise in air conditioning systems. Easily installed directly into the duct work, Aircoustat eliminates the need for costly, extensive duct lining. And results are astonishing: one *7 foot* unit reduces noise level below what *100 feet* of commercial duct lining could accomplish.

Engineered to provide broad band attenuation with low pressure drop, Aircoustat is available in 14 standard sizes for use with all styles and sizes of duct, and 8 types to meet any desired conditions. Selection is no problem: ***if it fits geometrically, it fits acoustically.***

Where to install Aircoustat

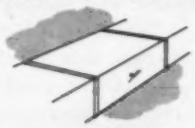


Aircoustats are incorporated as part of the duct work. If only selected areas require quiet, install above individual diffusers.

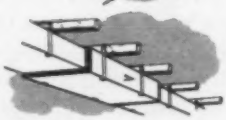


Where entire system is to be silenced, insert Aircoustat between fan and first length of duct. For areas requiring special silencing, two Aircoustats may be joined in series.

How to install Aircoustat



Aircoustat requires no special tools for installing. It is constructed to be joined to ductwork with a lock seam.



If ductwork and Aircoustat differ in size, a canvas or asbestos coupling may be used. If ductwork is hung, support Aircoustat similarly.

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Hardened, Honed Seats

for tough throttling service

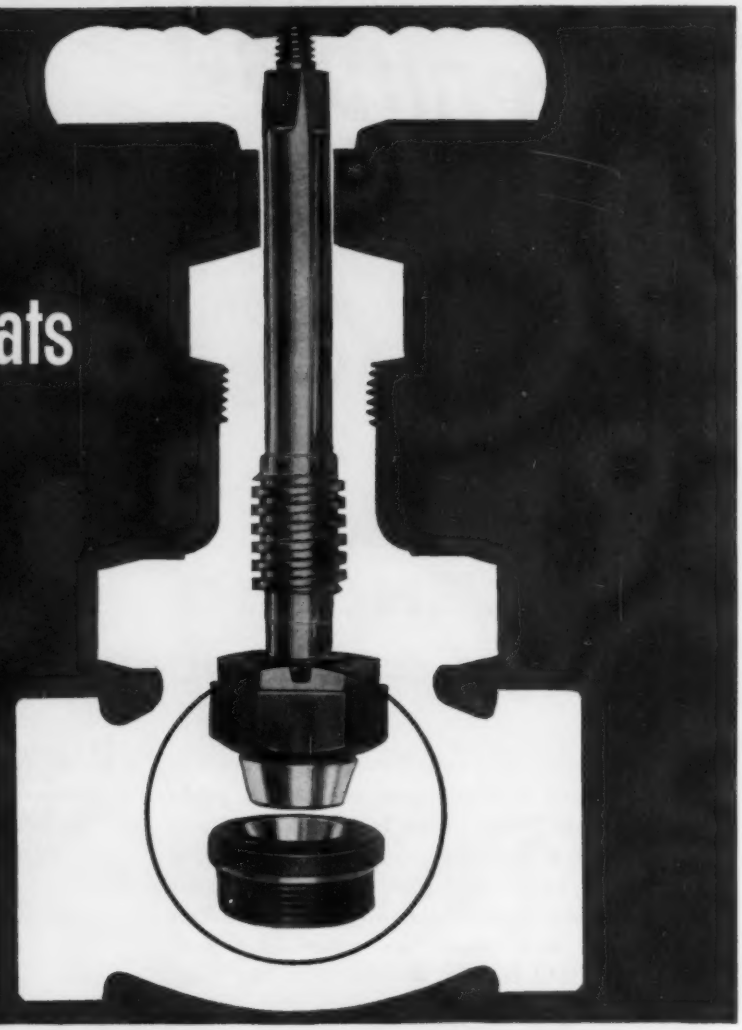

Fig. No. 558, bronze globe valve, 200 lbs. WSP, @ 550°F., 400 lbs. WOG, non-shock

A plug-disc and seat so hard they can crush scale between them and still close tight. A stem that absolutely will not gall or seize. The combination is in a rugged bronze valve designed for tough throttling service . . . the OIC 558!

Both plug-disc and seat are stainless steel, heat-treated to more than 500 Brinell hardness. Their seating surfaces are ground and *honed* to an accurate, smooth, bearing finish. The stem is OIC *alloy-40*, a sturdy bronze which won't gall or seize.

Remember, in throttling service a valve's stem, plug-disc and seat must withstand the most abusive wear. Rely on the toughness designed into this OIC line to give you extra-long service. Specify the modern 558 where you need bronze globe valves for throttling.

Write for Form No. 1001 which describes this valve along with the entire OIC 500 line, including composition disc and spherical disc globes, angles and check valves.

Call your OIC Distributor.

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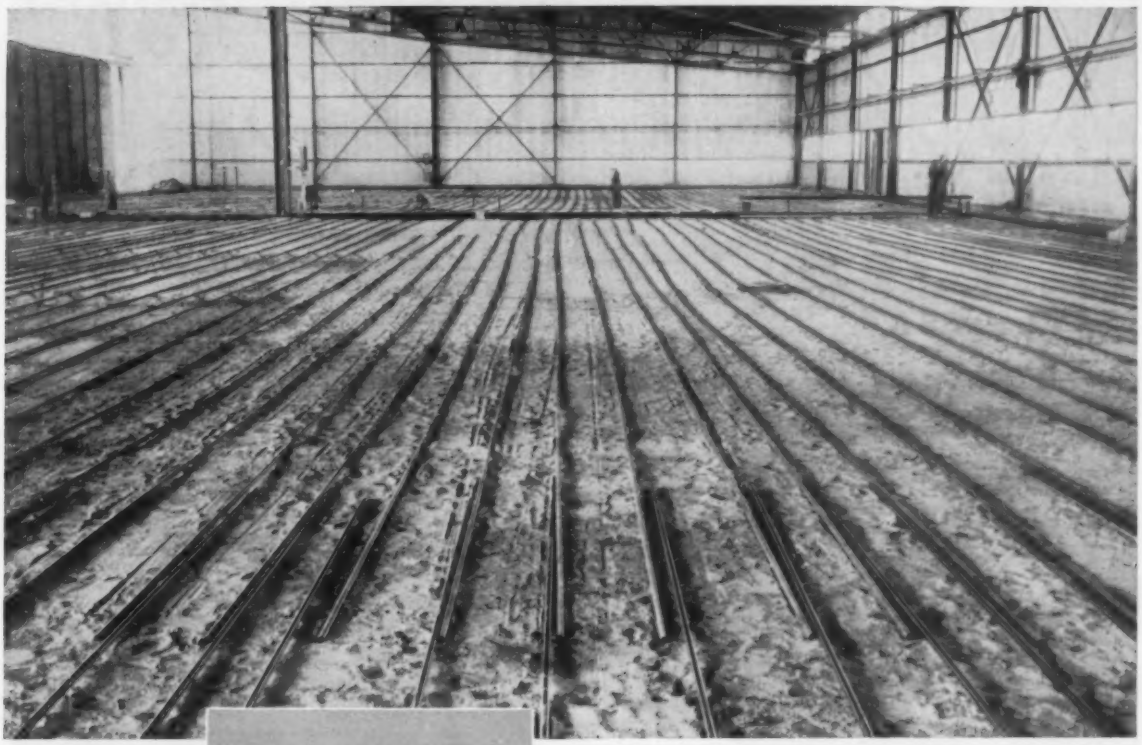
VALVES | **FORGED & CAST STEEL, BRONZE & IRON, LUBRICATED PLUG VALVES**

P-507

YOUNGSTOWN specified for radiant heating at O'Hare field



Airplane Hanger, O'Hare Field, Chicago, Illinois. Lundstrom & Skubic, Chicago, architects. George J. Ramas Construction Co., Chicago, general contractor. Reliable Heating Co., Park Ridge, heating contractor. Bell & Gossett Co., Morton Grove, heating material.

7 reasons why YOUNGSTOWN PIPE was selected

1. Uniform Ductility
2. Uniform Lengths
3. Uniform Threading
4. Uniform Weldability
5. Uniform Wall Thickness and Size
6. Uniform Strength and Toughness
7. Uniform Roundness and Straightness

Modern radiant heating will be keeping this 52,000 sq. ft. hangar snug when winter winds sweep O'Hare Field in Chicago. Snow, blown in when hanger doors are open, will melt immediately instead of creating a hazardous condition.

Projects such as this are typical of our jet age. And, the fact that Youngstown Pipe was chosen for this heating job is another evidence of its recognized dependability. Made only of the finest steel—its quality closely controlled by one producer from ore mine right through to the final threading operation—the Youngstown Pipe buried in the concrete floor will provide adequate heating service for years to come.

Next time you order pipe, be sure you get YOUNGSTOWN.

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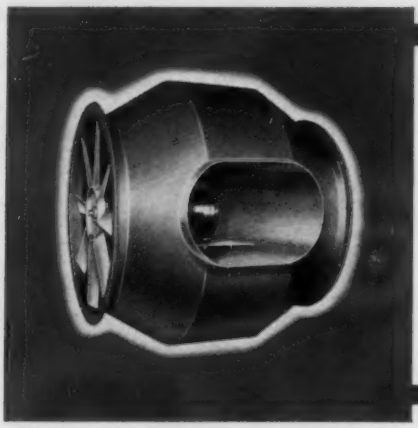
There's a HARTZELL Fan or Blower to Power Your Ventilating System

Hartzell Duct Fans

Say good-by to high installation and maintenance costs when you choose a Hartzell Duct Fan. Built as a prefabricated duct section, it bolts into place easily in any duct system, leaving the motor readily accessible for maintenance. This rugged and reliable fan fits any duct system for removal of flammable fumes, corrosive elements, or abrasive dust. Sizes from 12″ to 60″ in both belt-drive and direct-drive models.

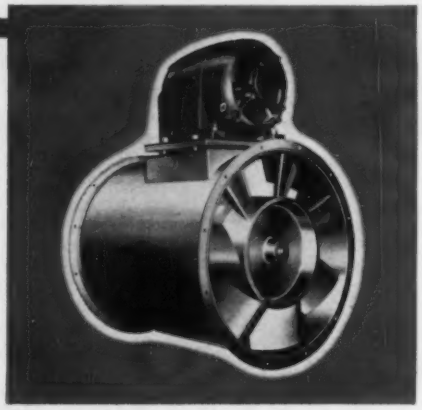


The *NEW* Hartzell Bi-Pass Duct Fan

Here is the ideal fan for high temperature operations such as ovens and oil and gas fired induced draft boilers and for moving corrosive fumes. Designed with the motor mounted in a tunnel out of the air stream, the Bi-Pass Duct Fan is available in diameters from 19″ to 41″. Operates in temperatures to 300° in standard construction, to 550° with special high-temperature, heavy duty construction.

Hartzell Vaneaxial Blowers

These rugged units are designed for trouble-free performance and long life in punishing industrial applications. All welded, heavy gauge steel construction. Ten belt drive sizes, 12″ to 54″, six direct drive sizes, 18″ to 42″. The new High-Temperature model moves air at temperatures up to 350° or air containing acids and alkalies without danger of premature failure of the belt or bearings. Other models operate efficiently against pressures as high as 10″ water gauge.



HARTZELL

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☐ The new Bi-Pass Duct Fan

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Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

WAGNER offers something NEW in small motors

More compact capacitor-start and split-phase motors—¼ hp and below—*that help the design engineer in a tight spot!*

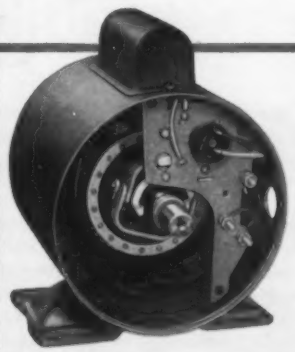
For design engineers who've been looking for more efficient fractional horsepower motors with less bulk... here's good news!

Now, you can get smaller, more compact Wagner capacitor-start and split-phase fractional horsepower motors with many new added features such as *a new endplate design, a new lubrication system that permits all-angle mounting and a new terminal board and switch location.*

Yet these re-designed motors retain all of the proven features that have made Wagner motors famous for quality for more than 60 years. Bulletin MU-200 gives complete information—write today for your copy.

When you specify Wagner Motors—you get the advantage of a liberal warranty... of nationwide service facilities, with on-the-spot service, replacement motors and parts available from 25 Wagner-owned Service Branches and more than 850 Authorized Service Stations. You can choose from a wide variety of types and sizes—singlephase or polyphase—from 1/25 to 400 horsepower.

Inside view of sleeve bearing endplate with seal removed to show felt packing used for lubrication. In addition to the continuous strip, a spring-loaded piece of felt makes constant-pressure contact with the shaft through an opening in the top of the bearing.



View of the type RK motor with endplate removed showing terminal board on which thermal protector and quick-break switch are mounted. Note thickness of steel frame which has been machined for accurate endplate fit. Rigid base is welded directly to the frame.

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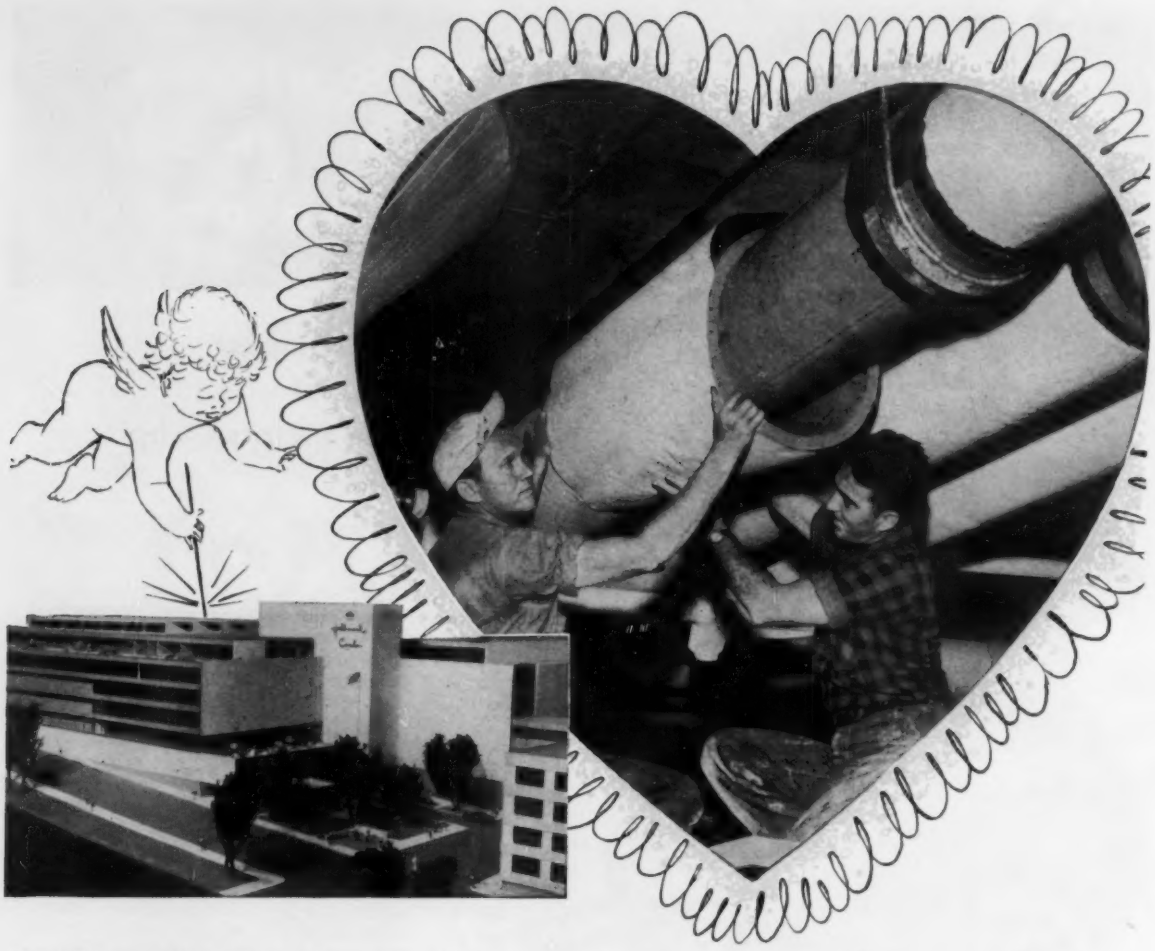

Hallmark Cards cared enough to put on the very best . . .

GUSTIN gb BACON SNAP*ON

One of the Midwest's outstanding buildings is the new Hallmark Cards building in Kansas City, Missouri, home of the famous manufacturer of greeting cards for those "who care enough to send the very best".

Inside this enormous structure, 50,000 feet of hot and cold lines are insulated with G-B Snap*On pipe insulation—the new one-piece molded pipe insulation of fine glass fibers. Thermally, it is superior to any comparable product. It is also far lighter in weight, far easier to handle, far more economical to apply. One-piece sections are available plain or with muslin for heated piping, or with vapor barrier jackets adhered for chilled lines. As the photo indicates, they go on the pipe as quickly as you can say "Snap*On"—and they will do their job indefinitely because they are as permanent as glass itself.

Modern plants of every type throughout the country are selecting Snap*On for chilled lines or heated piping where temperatures do not exceed 350° F. You, too, can put on "the very best" and *save money in the bargain!* Write this very day for samples and complete technical literature.

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe couplings and fittings • Molded glass fiber pipe insulation

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National Biscuit Company
Chicago, Illinois

Architect: Alexander D. Crossett, New York, N. Y.
General Contractor: Ragnar Benson, Inc., Chicago, Ill.
Heating Contractor: Robert Gordon, Inc., Chicago, Ill.

Airtherm

90 VERTICAL DISCHARGE HEATERS INSTALLED from 102,500 BTU to 185,000 BTU

92 HORIZONTAL DISCHARGE HEATERS INSTALLED from 14,800 BTU to 250,000 BTU

STEAM UNIT HEATERS

WARM THE WORLD'S LARGEST BAKERY

To achieve flexible, economical heating throughout Nabisco's new $20 million Chicago plant, 182 Airtherm steam unit heaters have been installed. The plant is the world's largest cracker and biscuit bakery with ovens the length of football fields, almost 20 acres of floor space and a capacity of 167 million pounds yearly.

When the area to be heated presents unusual problems, chances are you can solve them easily and economically with the flexibility of Airtherm unit heaters.

Convectors

Vertical Steam Unit Heaters

Horizontal Steam Unit Heaters

Centrifugal Fan Type Unit Heaters

Direct Fired Space Heaters

Gas Fired Unit Heaters

FOR HEATING SATISFACTION . . . THINK FIRST OF

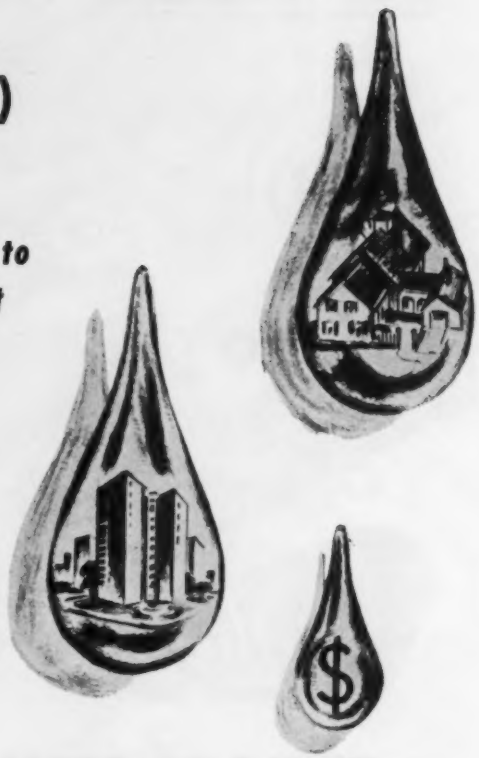
Airtherm

MANUFACTURING COMPANY

700 South Spring Avenue • St. Louis 10, Missouri

Little Drops of Water (Condensation)

Ruined a Fine Home
Cost over a Million Dollars to an Apartment Development



The owners of a path-breaking apartment development had to pay a repair bill of over a MILLION DOLLARS for ripping out condensation-soaked insulation and replacing damaged plaster walls.

It was necessary to move a fine country home to a new site—the state highway was coming through. It could not be done. The sills of the house had rotted on account of condensation in the walls.

Today's tightly built, high-humidity houses create vapor problems. Vapor, which is a gas, has 1/205,000 the density of water at 32°F; about one millionth the density at 0°F. Sometimes there is excessive flow of vapor THROUGH walls and ceilings into cold building spaces. This enhances the formation of destructive condensation, especially where an adequate vapor barrier is lacking, or where there is one with too many breaks, or which while waterproof is not sufficiently vapor-proof.

METALS ARE THE BEST VAPOR BARRIERS

There is now a new*, multiple aluminum, which forms a *continuous*, edge-to-edge "blanket" of uniform depth between studs or joists, giving the entire area maximum protection against vapor-flow and condensation formation as well as against heat loss or intrusion.

The aluminum sheets, 375 ft. to 750 ft. long are almost impervious to water vapor. Infiltration under the flat stapled flanges is slight. Condensation formation, on or within this type of insulation is minimized because of the scientific construction of multiple layers of aluminum, fiber, and air spaces.

The surfaces of this aluminum have high heat ray reflectivity (97%); low absorptivity (3%); and low emissivity (3%). Conduction is slight because of preponderant air spaces of low density. Aluminum and fiber layers retard convection, outer and inner. It is available, prefabricated, as Infra Type 6 or Type 4.

*Patent applied for.

The U. S. NATIONAL BUREAU OF STANDARDS has published an informative booklet describing the destruction that condensation can cause and means of prevention. It is entitled "Moisture Condensation in Building Walls." Send us coupon for a FREE copy.

COST OF EDGE-TO-EDGE INFRA
Multiple Aluminum Insulation installed in new construction between wood joists, material and labor

Type 6-PS about 10¢ sq. ft. Type 4-PS about 8¢ sq. ft.

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☐ Please send FREE U. S. Bureau of Standards Booklet BMS 63.
☐ Please send FREE Infra Insulation samples.

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THE EDITOR'S PAGES

IN CASE OF FIRE

When Mrs. O'Leary's celebrated cow kicked over the lantern that touched off the Chicago conflagration of 1871, she unwittingly kicked off one of the most significant movements in the nation. The fire prevention movement has progressed steadily ever since Fire Prevention Day was inaugurated October 9, 1911, the 40th anniversary of the great fire. Mounting fire destruction caused President Harding to proclaim an entire week as Fire Prevention Week. Yet despite educational efforts, 10,000 Americans still lose their lives in fire each year, many by panic. Therefore, along with a greater public awareness of the seriousness of the fire hazard, we need improved designs for structures that are not only fireproof but panic-proof as well, in order to avoid this needless slaughter year after year.

Hot Summers Minded Worse Than Cold Winters

. . . 360,000 ask weather in one day

TELEPHONE WEather 4-1212, weather service of the telephone company in Chicago, received an all time high number of calls one day last July, when the temperature was over 100 F in the shade. By mechanical count, 359,257 persons dialed the number, breaking the previous records, always set in the winter. The average number of calls per day is 42,000.

Such figures prove either 1) that more people are using the telephone weather service or 2) that people are bothered more by hot summer weather than by cold winter. Certainly, they indicate that people are more conscious than ever of the physical environment.∓

Members of HPAC's Board Win Awards, Catch Prize Fish

CHARLES S. LEOPOLD, Philadelphia consulting engineer since 1923, and a member of HPAC's board of consulting and contributing editors, will be awarded a Frank P. Brown medal by The Franklin Institute at its Annual Medal Day ceremonies, October 19. He is being cited "in consideration of his outstanding contribution to air conditioning, particularly in the research and development of air conditioning techniques and the application of air conditioning to a wide variety of important structures." Among these structures are the Pentagon, the Unted States Capitol, New York Stock Exchange, Madison Square Garden, Fidelity-Philadelphia Trust building, and the Philadelphia Convention Hall.

In addition, he is the most recent recipient of the F. Paul Anderson Medal, highest honor awarded by the American Society of Heating and Air-Conditioning Engineers. He is a member of The Franklin Institute, Fellow and past president of the American Society of Refrigerating Engineers, and a Fellow of the Royal Society of Arts of Great Britain. He is also a member of Sigma Xi and Eta Kappa Nu and is in Who's Who.

Another member of the HPAC's board of consulting and contributing editors, Samuel R. Lewis, Chicago consulting engineer who also has received the F. Paul Anderson award was singled out for another award recently. He was named Doctor, Consulting Engineer, *summa cum laude*, by the Heating, Piping & Air Conditioning Contractors Chicago Association, at the latter's annual dinner, "for distinguished service in his profession, for contributions to the science of mechanical engineering, and for the promotion of the welfare of the industry. . ."

FISHERMAN M. K. FAHNESTOCK, right, evidently has what muskies like. He lured another prizewinner in Wisconsin waters in August

Still another member of HPAC's editorial board, M. K. Fahnestock, professor of mechanical engineering and chairman of the Physical Environment Unit at the University of Illinois, received a prize of a different kind. Last month, after 20 years of trying to hit the muskie fishing jack-pot again, he succeeded in catching the largest muskie to date in the Gile Flowage area near Hurley, Wis., and Ironwood, Mich. Vital statistics of his prize catch: 48½ in. 30½ lb, 12 years old. This is ½ in. longer but 4½ lb lighter than the tiger muskie he hooked 20 years ago, which is mounted in his office.

Professor Fahnestock's muskie '55 had been the objective of local guides and fishermen all season. The third largest netted and tagged — No. 79 — by the conservation department in April, it had grown 1 in. during the summer and was caught 1½ mi. from where it was tagged. The guide, a 17 year old high school junior, recognized the fish as soon as it was brought into the boat.

A few days later, our angling editor caught a second large muskie, 43½ in. long, and weighing 24 lb.

Accompanying Professor Fahnestock on his successful fishing trip was E. P. Heckel, Sr., of E. P. Heckel & Associates, consulting engineers, and — yes — another of HPAC's board of consulting and contributing editors.∓

Construction Activity Sets Record Highs

. . . awards rise 27 percent

OUTLAYS for new construction continued at peak levels in August — the latest month for which figures are available — totaling nearly $4 billion. Expenditures reached an all-time high of $27.1 billion for the first eight months of the year, according to the Departments of Labor and Commerce. After adjustment for seasonal factors, new construction activity in August was at an annual rate of $41.5 billion.

The total value of new work put in place was 8 percent above the previous August high in 1954. Private expenditures in August 1955 — $2.8 billion — were 12 percent above 1954, while total public outlays — $1.2 billion — were off slightly.

Activity on stores and similar mercantile establishments showed an unseasonally sharp increase, reaching a new monthly peak.

Contracts for future construction in the 37 states east of the Rockies also set an alltime high for August, totaling $1,894,841,000. This was 20 percent higher than August 1954, according to the F. W. Dodge Corp.

Contracts for the first eight months totaled $16,130,149,000, up 27 percent from last year.

Other August figures were: nonresidential building, $681,463,000, up 24 percent above 1954; residential building, $835,418,000, up 21 percent, utilities and public works, $337,960,000, up 15 percent.

Eight months: nonresidential building, $5,706,605,000, up 24 percent; residential building, $7,232,168,000, up 33 percent; utilities and public works, $3,191,376,000, up 21 percent.‡

Weather Data Needs Of Building Industry

. . . reported in survey

A SURVEY of the major segments of the building industry to determine the kind of weather data needed to supplement currently available information was completed recently by the Climatic Research Committee of the Building Research Advisory Board.

Some requests were for data already available from the Weather Bureau or from organizations such as the Naval Observatory. By working with specialists in meteorology, much of the information already available can be produced in a form especially suited to the individual needs of architects, engineers, and others.

In addition to data already available, the U. S. Weather Bureau will make available soon: monthly reporting of hourly wet bulb temperatures; summaries of summer and winter dry bulb and wet bulb temperatures; summaries of wind velocities and directions; summaries of rainfall and snowfall; and 30 day forecasts.‡

New Zirconium Alloy Resists Corrosion

. . . in nuclear reactors

A NEW ZIRCONIUM ALLOY is so resistant to the extremely corrosive action of high temperature, high pressure water in nuclear reactors that in a year's time only 1/10,000 in. of corrosion can be measured, according to the atomic power division of the Westinghouse Electric Corp.

The new alloy, called Zircaloy-2, is the result of months of trying to find a structural metal capable of withstanding the intense corrosive attack of water under high temperature and pressure.

The new alloy contains 1.5 percent tin, 0.12 percent iron, 0.10 percent chromium, and 0.05 percent nickel.‡

Heat Brakes Office Work 75 percent, Survey Shows

. . . stenographic errors rise

AN EFFICIENCY survey of Chicago office managers shows startling figures on accuracy and output in hot weather, according to the Pyle-National Co. Managers said average errors of typists rise from 11 to more than 95 an hour as the temperature rises from 78 to 96 F.

One manager, whose company kept statistics on efficiency in drafting work during a heat wave, said performance improved 75 percent after the heat wave passed.

Other findings: absenteeism and employee turnover are reduced sharply after air conditioning is installed; employees don't stampede to get out of air conditioned offices at quitting time.‡

Mobile Air Conditioners Cool Guided Missiles

. . . deliver air at 20 F

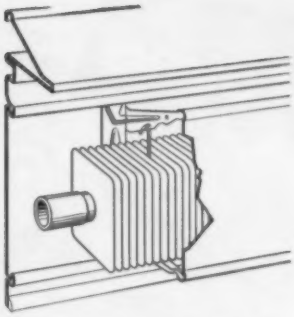
MOBILE air conditioning units capable of delivering air as cool as 20 F are now being used with guided missiles. The unit maintains the air temperature at a constant level, with a tolerance of ± ½ F. Defrosting equipment assures uninterrupted operation below freezing.

Cool air is carried from the unit to the delivery point by a flexible, fabric-covered duct with high resistance to heat conduction or absorption. The ducts are of three-ply construction, consisting of a liner and blanket of glass fibers, and a heavily coated outer skin, according to Flexible Tubing Corp. The unit uses three 25 ft long 8 in. ducts.‡

"Quote"

"While the rise in the American standard of living has received much attention, we have been less conscious of the parallel rise in our standard of working. . ."—*Leland I. Doan, president, Dow Chemical Co.*

"Everybody's a Prospect for WEBSTER TRU-PERIMETER HEATING" says Elmer C. Lind



Sectional view of Webster Baseboard Heating element and enclosure.

With Chicago Heating Contractor Elmer C. Lind, it's Webster Tru-Perimeter Forced Hot Water Heating for winter-long comfort at low fuel cost . . . with either Webster Baseboard Heating or Webster Walvector®.

Lind has used this modern system for wall-to-wall heating in homes, apartments, motels, country clubs, trucking terminals, stores, medical centers, and many other types of buildings. He has installed Webster Baseboard to modernize the heating in about 50 homes.

"Webster Tru-Perimeter Heating has sales appeal both for the builder and for the ultimate owner," says Mr. Lind. "It's easy to install and the owner is always pleased with the job. And we like the service we get from the manufacturer and the Webster Representative.

"Savings in fuel cost, reduced maintenance and increased comfort give me a competitive advantage," he added, "and the eye-appeal in both Webster Baseboard and Webster Walvector usually clinches the deal."

Ask your Webster Representative for more information about Tru-Perimeter Forced Hot Water Heating with Webster Baseboard, Webster Standard Walvector® and Webster Custom Walvector®; or write us.

Address Dept. HP-10

WARREN WEBSTER & COMPANY

Camden 5, New Jersey : : Representatives in Principal U. S. Cities

In Canada, Darling Brothers, Limited, Montreal

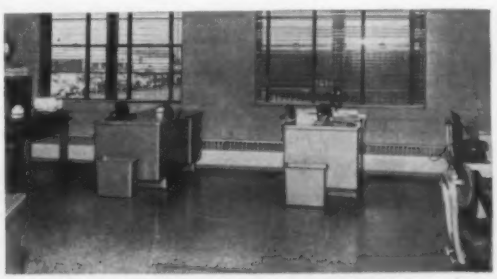
Webster

TRU-PERIMETER FORCED HOT WATER HEATING

SEE **"Design for Comfort", the 30-minute 16-mm. sound motion picture about Webster Baseboard Heating. Available without charge through Webster Representatives. Now booking for showings after May 1st.**

Webster Walvector gives clean, comfortable warmth in washroom of Southmoor Country Club, Orland Park, Ill. Owner: Ben Stevenson. Architect: J. Kocher, Flossmoor, Ill. Heating Contractor: Elmer C. Lind.

Webster Baseboard heats 18 apartments in the Carl B. Anderson Building, Chicago. Architects: Ben and George W. Larson, Chicago. Owner and General Contractor: Carl B. Anderson. Heating Contractor: Elmer C. Lind.



Webster Walvector heats offices of Shippers Dispatch, Inc., Forest View, Ill. Architect: T. C. Buss & Associates, Chicago. Builder: Arthur E. Nelson, Chicago. Heating Contractor: Elmer C. Lind.

proved
Actual bids are confirming this Nesbitt claim!
COMFORT AND PROTECTION INCREASED
SYSTEM COSTS REDUCED 20% OR MORE
You, too, can save with Nesbitt Series Hot Water Wind-o-line System
Every day brings reports of new school awards in which heating and ventilating costs are 20% or more below the norm because of the protective Nesbitt Series Wind-o-line System—in which the tubing serves as the supply and return mains.
Heating and ventilating classrooms with Nesbitt Syncretizers and Wind-o-line Radiation in series hot water circuits, saves 20% or more of the construction, equipment, and installation costs of conventional piping systems with trenches and runouts.
For instance: One new $1,681,000 Pennsylvania school ($162,000 for heating and ventilating) saves an estimated $42,000 with the Nesbitt System—by a reduction in pipe trenches, smaller pipes and pumps, and less pipe covering and controls.
A new Ohio school will get Nesbitt unit ventilation and Wind-o-line protection for less than the estimated cost of warm-air heating! Other new schools will enjoy the increased comfort and cold-wall protection of this system at comparably lower costs.
Although savings and convenience are undeniable advantages of the Series Wind-o-line System, of added importance are the increased comfort of variable water temperature control, cold surface protection, all-year temperature maintenance.
If you don't have Publication 104 be sure to send for it today.
Construction cost data bulletins free on request
Made and sold by John J. Nesbitt, Inc.
Sold also by American Blower Corporation
Nesbitt
THE HEATING AND VENTILATING SYSTEM THAT SETS A NEW STANDARD OF CLASSROOM COMFORT

What d'ya mean ...'saves 20%'!

All right, Mr. Contractor, you've read our claim that with the Nesbitt Series Hot Water Wind-o-line System of heating and ventilating, a school can save 20 per cent or more of the construction, equipment, and installation costs entailed by the conventional system with trenches and runouts —and you ask "How come?" Here's how:

1. In the *series system* the Wind-o-line piping is the supply and return for the unit ventilators, eliminating costly pipe trenches, mains, runouts, and pipe covering. *Saves on construction.*

2. Water temperature is related directly to outdoor temperatures; heating capacity is assured with one-half to one-third the water; smaller pipes and pumps are used. *Saves on equipment.*

3. With smaller, shorter, simpler pipes and mains, and difficult piping factory-assembled within the Syncretizer unit ventilators, labor costs at the site are reduced. *Saves on installation.*

A school can SAVE, yet can HAVE the last word in thermal comfort

Groups of classrooms or entire wings are arranged in series-loop circuits. The copper tubing of the Wind-o-line radiation is the only required supply and return piping for the Syncretizer ventilating units. System water temperature is maintained in direct relation to outdoor temperatures: the Syncretizer control of room temperatures is improved; Wind-o-line protection against window downdraft and bodily heat loss is always related to actual needs. Without other investment, this equipment maintains safe overnight building temperatures. The whole amazing story is told in Publication 104.

Nesbitt SERIES WIND-O-LINE SYSTEM

Made and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa. • Sold also by American Blower Corporation

"OPEN FOR DISCUSSION"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Contamination, Entrainment Mean Extra Maintenance for Fan Blades

THE COMMENTS by Martin G. Beline in the September HPAC, based on the article, *Forced or Induced Draft?*, which appeared in the May HPAC, contained a statement that I feel needs clarifying. While Mr. Beline is undoubtedly better versed on draft fan design, construction and application than I am, I would like to explain what I think is a misinterpretation.

My comments on the subject in July HPAC mentioned that induced draft fans were subject to contamination and entrainment of products of combustion resulting in unbalance. My meaning was that the fan blades themselves, being in the stream of combustion gases, were subject to these difficulties and, therefore, require frequent cleaning.

Mr. Beline has interpreted my statement as applying to the motor bearings. This was certainly not the impression that I intended to give. However I did state that the high temperature presented additional maintenance troubles in the case of motor bearings, and Mr. Beline has replied with a suggested design in which the bearings are isolated from the stream of hot gases.

Our own field information indicates that induced draft fans with which packaged automatic boilers are equipped require additional maintenance.

S. D. DISTELHORST
Sales Promotion Manager
Orr & Sembower, Inc.

Extreme Cost Cutting in Installation Can Risk Engineer's Reputation

I ENJOYED reading the article, *Partial Spot Cooling Cuts Cost of Air Conditioning Newspaper Plant*, by C. L. Capps and M. L. Hoglund, in the September HPAC. It is well written and gives a very good explanation of the air conditioning system under discussion.

The engineer who selected the central equipment used a little more courage in cutting the size of the refrigerating plant than I believe I could muster. My experience with owners when the equipment was cut to a very minimum has not been very good. Even though the owner understood that he was getting a very tightly sized plant, he would become very critical after the system had been in operation for a while. Owners seem to have a very short memory. One can beef up his equipment sometimes, but the engineer usually has his reputation tarnished somewhat even though he is entirely innocent of any wrongdoing.

Many owners, because of a shortage in the pocketbook department, are forced to ask the engineer to cut all available corners, and the engineer is forced into the position of either turning the job down or going along with the owner.

However, the system outlined in this article seems to be very well conceived and thought out. It should give satisfactory service.

H. G. GREGERSON
Gregerson & Gaynor, Engineers

Clarifying SBI Boiler Load Ratings Shows Difference Not So Great

THE FOLLOWING comments are offered as clarification of some of the references to Steel Boiler Institute ratings in the article, *Burning Heavy Fuel Oils*, by Kalman Steiner, in August HPAC.

Actually, the difference between the rating of Table 1 and Table 2 steel boilers is not as great as one might think from reading the article. The steam ratings are approximately 20 percent higher per square foot of heating surface for the Table 2 boilers. SBI feels that this is justified, since Table 2 boilers must be tested. The ratings, although they are based on the heating surface of the boiler, must be substantiated by the test data and meet certain limitations on stack temperature, efficiency, etc., as required by the Code.

Table 1 boilers are rated on the basis of physical dimensions only and the heating surface is one of the most important dimensions used in the determination of the ratings.

SBI has not established a *gross* output rating for steel boilers, like that for cast iron boilers, rated according to the I=B=R Code. In the case of Table 1 boilers, an SBI rating and an SBI net rating are both shown. The SBI rating indicates the net load plus the piping that the boiler will carry and the SBI net rating indicates the net load the boiler will carry.

There is a difference between these two ratings of approximately 20 percent to cover the piping allowance. There is no gross output indicating the output at the boiler nozzle. This is generally accepted to mean the net load plus the piping plus the pickup.

If one wishes to use a gross output for SBI rated Table 1 boilers, a figure of 150 percent of the SBI net rating may be considered as quite conservative. The SBI rating in square feet of steam is determined on the basis of 17 sq ft of steam SBI rating per sq ft of heating surface.

For Table 2 boilers, SBI shows a net rating only. Boilers must be tested at outputs up to 175 percent of the SBI net rating and at 150 percent must be within the limitations of stack temperature, efficiency, draft loss, etc., as specified in the Testing and Rating Code.

The 150 percent of the SBI net rating may be considered as a gross output, although SBI has not officially designated it as such. The SBI net rating is determined on the basis of 17 sq ft of steam net rating per sq ft of heating surface. Even though the test data indicates the boiler could carry a higher rating, the SBI Code does not permit a higher rating than that determined on the basis of the heating surface.

The principal reason why SBI ratings are based on heating surface is that the Steel Boiler Institute requires standardization of boiler sizes for SBI rated boilers. Because of this program, the manufacturers can limit their production of sizes to those that adequately meet field requirements. This is instead of building a large variety of sizes merely for the sake of meeting competitive conditions. It has been found that standardizing sizes based on heating surfaces is a very convenient and satisfactory way to control the standardization program.

Table 1 boilers in the SBI Code refer to the larger or commercial sizes of boilers, while the Table 2 boilers refer to the smaller sizes. At one time the Table 2 boilers covered residential sizes only, but the basis on which Table 2 boilers are being rated has now been extended to cover boilers with ratings up to 5000 sq ft of steam net SBI rating.

Mr. Steiner states that "practically every manufacturer fails to show an adequate setting for either oil or stoker firing." There are two important reasons for this, one of which is shown in the table of maximum heat release rates in Mr. Steiner's article. It is apparent that the permissible maximum heat release rates vary widely in different cities. If a manufacturer showed a setting height adequate for one locality, it may not be satisfactory for others. Another reason is that the burner manufacturers themselves are not in unanimous agreement regarding setting heights and there is probably some justification for these differences due to different burner operating characteristics.

It should be noted that at least one boiler manufacturer catalogs large steel boilers with bases much lower than 15 in. These are especially designed for oil firing, and it is reported that oil burners installed in these boilers are giving good performance.

L. N. HUNTER
Senior Vice President
for Engineering and Research
National-U.S. Radiator Corp.

Church's Sub-Floor Heating System Installation Cost $18,750

IN MY ARTICLE, *New Church Heated by Large Sub-Floor Duct System*, in the September HPAC, the cost of the system was not given. The installed system, as described in the article, cost $18,750. Readers may be interested in this when considering similar installations of this type.

B. A. KOSARIN
National Heater Co., Inc.
Arnold A. Kosarin & Associates

We Can Air Condition an Iron Lung, But Is it Really Necessary?

I HAVE READ with interest the article, *How To Air Condition an Iron Lung*, by Tohru Inouye, in the September HPAC, and have a few comments to make.

The first respirator I made was in 1928. After we had reasonable hopes that it might prove to be a useful hospital appliance we went through many of the same tests that Mr. Inouye made and for exactly the same reasons. We ran a machine for hours in a warm room and cooled the respirator, while running, circulating air from the respirator through about a foot column of fair sized pieces of ice. Results were sufficiently promising, so we tried it with circulation through a water spray.

The results were good enough, so we were sure we could set up a usable cooler quickly from equipment available in any modern hospital (as of about 1929). Small unit air conditioners were not then available.

I have been responsible for a fair amount of complicated equipment for iron lungs — equipment that is not used and is not really needed. It is hard to resist the temptation of trying to make mechanical appliances take the place of good medical and nursing care. But, my guess is, after 25 years experience, that putting the machines in air conditioned wards rather than air conditioning the machines themselves will usually suffice.

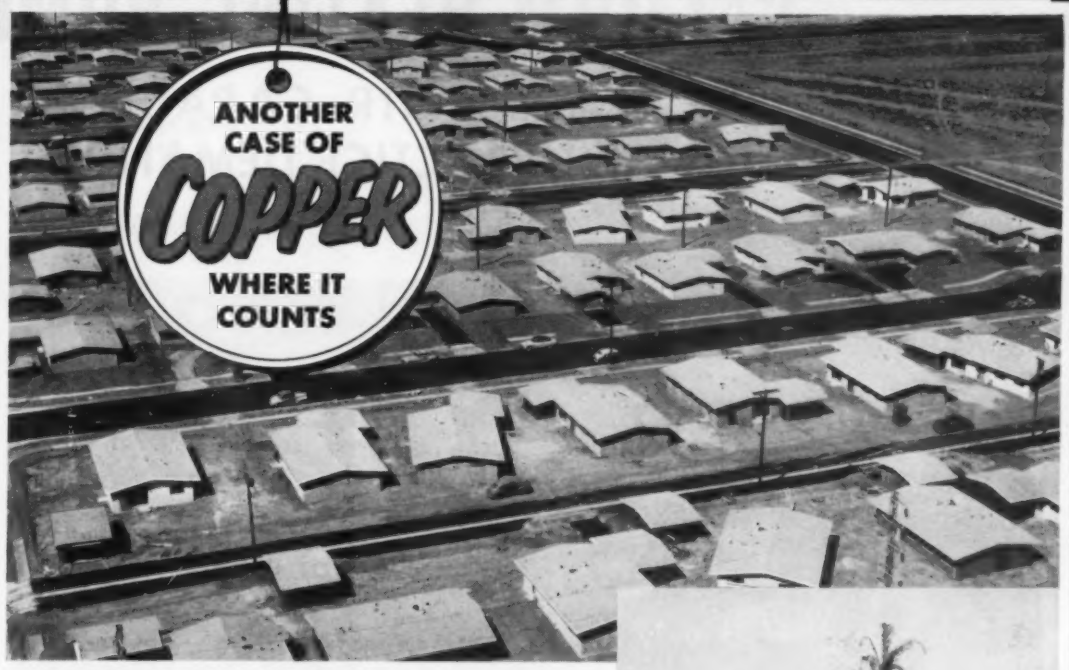
If efforts must be made to control the patient's body temperature because of fever, they had better be subject to the very simple things that the attending nurse can handle. A patient with fever and respiratory difficulty is extremely ill, obviously, and I would be very reluctant to substitute the best things we engineers can make to take the place of very simple and careful nursing care.

PHILIP DRINKER
School of Public Health
Harvard University

Paul L. Geiringer Co-Author of HTHW Article

THE ARTICLE, *$4 Million HTHW System Heats McGuire Air Force Base*, in the September HPAC, by Alexander Sage, should have shown the co-author as Paul L. Geiringer, chief engineer, American Hydrotherm Corp.

THE EDITORS



350-HOUSE BRISTOL PARK TRACT, Santa Ana, California

"Foot for foot, pound for pound, nothing installs as economically as COPPER WATER TUBE,"

Says GARY STICE
Earl O. Stice Co., Mechanical Contractors, Glendale, Calif.

Said Mr. Stice, "Whether or not codes call for copper when imbedding plumbing and heating lines or radiant panel heating coils in a concrete slab I play it safe and use copper anyhow. For with non-rusting copper, moisture and seepage are never a problem.

"And, as far as installation is concerned, fewer joints are necessary with copper water tube. Then, too, you can always be sure that the few solder joints that you do make are tight . . . a mighty important item when you're imbedding in concrete. So with all these advantages of copper water tube you can see why I have found it the most economical material to install."

You will find Revere Copper Water Tube installs economically when used for plumbing lines, radiant panel heating, air conditioning, underground service lines, waste, stack and vent lines, processing lines.

And if you want to know the short cuts, or have installation problems, involving Revere Copper Water Tube, let us know and we'll put you in touch with our Technical Advisory Service.

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COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
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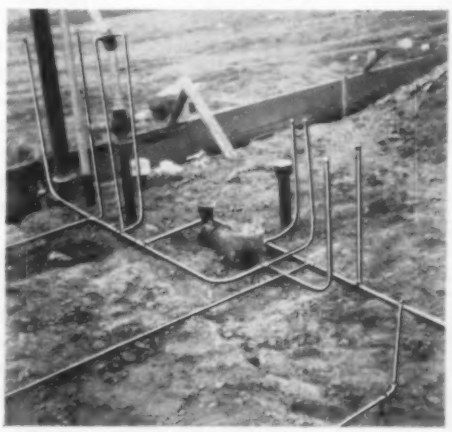
Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

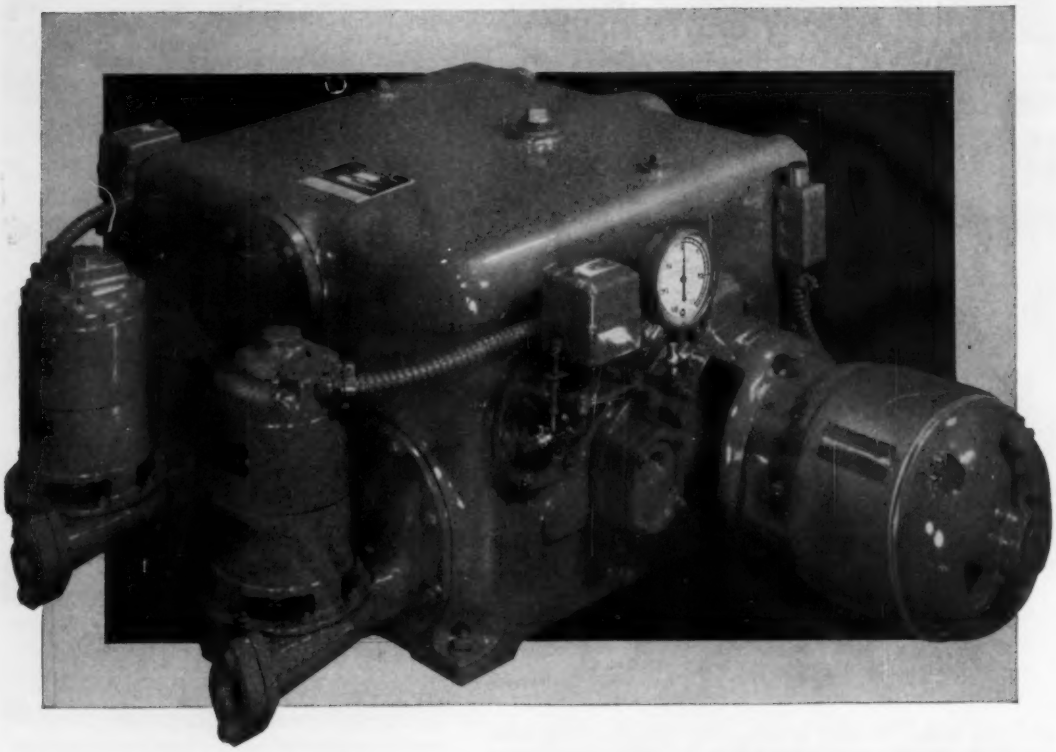
ONE OF THE HUNDRED completed homes shown in the large aerial view above. There will eventually be 350 homes in this tract. 34,000 feet of enduring Revere Copper Water Tube have already been installed in the first hundred homes in ½", ¾" and 1" sizes. Bldr. and Gen. Cont.: M. J. BROCK & SONS, INC., Los Angeles, Calif. Revere Dist.: KEENAN PIPE & SUPPLY COMPANY, Los Angeles, Calif.



NON-RUSTING REVERE COPPER WATER TUBE before imbedding in the concrete slab.

THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.

By Lewis Smith
Heating Engineer

1 TWELVE STORIES HIGH, the 385 Madison Avenue building occupies an entire block without setbacks, wings, or courts

Air Conditioning Helps Convert Loft into Premium Office Space

This 30 year old building, originally constructed for furniture showrooms, has, with the help of air conditioning, been turned into first class office quarters to meet the demand for office space in New York's Grand Central area. Not only has rental income been increased, but heating costs have been cut 17½ percent.

• The problem — that of ventilation and cooling — was solved at a cost of $1,700,000 for the air conditioning system. This included necessary structural changes and all equipment. No change was made in the existing two-pipe forced hot water heating system.

Because each half of the double building has separate services, there are two air conditioning rooms on each floor. Exterior wall spaces are all on separate zones, thermostatically controlled. Interior spaces, under the control of the return air temperature, can use up to 100 percent outside air without overcooling the perimeters.

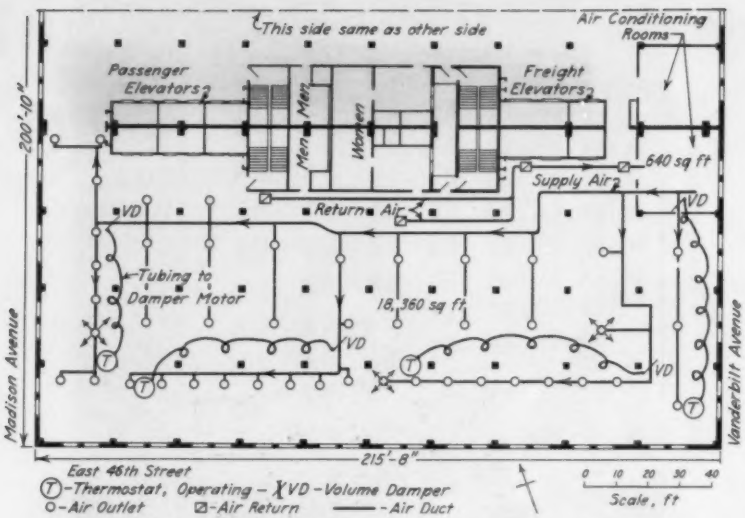
Overhead supply ducts and outlets distribute from 16,000 cfm to 29,000 cfm, total volume of air. Return air intakes are spaced along the return ducts in the corridors. Each tenant decided whether to install hung ceilings at his own expense or to leave the ducts exposed.

ONE OF AIR CONDITIONING'S greatest advantages is that it permits the use of large area block-type buildings for office space which formerly contained unusable interior spaces far from the exterior walls. And this 100 percent coverage of the land can then yield a greater return on the investment.

Such a building is the one at 385 Madison Avenue, New York, which occupies an entire block, 200 x 216 ft, without setbacks, wings, or courts. Twelve stories high, it has a 13th story penthouse somewhat smaller than the rest, which is served by separate elevators from the 12th story.

Actually, the building was originally constructed in two sections, the north half in 1922 and the south half in 1927. Each building was complete in itself, with separate services. The floor plan is in Fig. 2.

The original idea was that these buildings would be occupied by firms



2 FLOOR PLAN of former loft building shows how air conditioning was installed to make interior spaces habitable as offices. Twin air conditioning rooms are on each floor. Two 700 ton compressors are in the basement, and a cooling tower is on the roof

such as furniture manufacturers who, in addition to offices, needed large display rooms and repair shops. Thus, the offices could be placed along the outer walls, and the display rooms, which had light occupancy, could utilize the interior spaces without need for air conditioning.

However, the location is in the heart of the Grand Central area, where the demand for office space has increased enormously in recent years. Of course, a much higher rent per square foot could be obtained for offices than for show rooms. Some space was rented for offices, but the interior clerical spaces were at times so hot that one large tenant allowed a half hour break, morning and afternoon, during which all windows were opened wide.

The building, as it was, was unsuitable for full office occupancy and seemed likely to become a "white elephant," until the real estate firm of Webb and Knapp saw what could be done by air conditioning. They purchased the building and completed its conversion to an office building. 50 percent of the area on each floor — from the third to the 12th floor inclusive is 25 ft or more from the exterior walls (exclusive of service areas). This space would ordinarily be considered unfit for office use unless air conditioned. Thus, the first and absolutely essential step was to install a proper air conditioning system.

Heating System Left Intact

To keep the first cost down to economical limits, it was decided to leave the heating system intact and to install a separate cooling and ventilating system. Of course, such an installation in an existing building requires structural changes to accommodate the compressors, cooling tower, ducts, intakes, etc. Including all these changes, the complete cost of the air conditioning system was about $1,700,000.

The existing heating system is a two-pipe forced hot water type with convectors under each window. The risers are exposed and uncovered. The hot water is pumped through the building from a plant operated by the New York Central railroad. There are no circulating pumps in the building, two-thirds of which stands over the tracks entering the Grand Central station. The railroad controls the water temperature, from 190 F in cold weather down to 140 F in mild weather. The only control exercised by the building is by throttling the flow to vary the temperature drop, which may run from 20 to 40 F, according to the need for heat.

Location Poses Problems

The problem of how best to ventilate and cool the building to make the interior spaces habitable for office workers was designed by the consulting engineers, Jaros, Baum & Bolles, in cooperation with the architects and Albert W. Lewis and Rudolf C. P. Boehler, of the Webb and Knapp organization.

One of the few cases where a loft building has been converted into an office building through the means of air conditioning, this building was one of the first complete installations of air conditioning in an existing office building — other than by individual self contained units — in New York City.

With the limited basement area due to the location over the tracks, there was barely sufficient room for installing the two 700 ton centrifugal compressors. Of necessity, the air handling equipment had to be located elsewhere. Whether to choose a large air unit on the roof or individual units on each floor, the decision was made, after a study of first cost and operating results, to use the latter. Possibly today, with developments which have taken place in the equipment for the handling of air at high velocities through ducts and ceiling outlets, a single high pressure unit on the roof might be used. If this were done, about 3 percent of the total rentable area now occupied by the individual units could be saved. But experience on this job and comparison with others show that the decision made was a wise one, as will be explained later.

Static Pressure Regulates Air

The location of the air conditioning rooms is shown in Fig. 2. Outdoor air is supplied through louvers installed in one window in each room and passes through filters, a steam preheat coil, a chilled water cooling coil, and a steam tempering coil into the supply fan.

By controlling the static pressure,

which is done both automatically and manually, the air volume can be varied from about 16,000 cfm to 29,000 cfm. The temperature of the discharge air can be varied by the usual means.

The return air fan is rated to handle about 80 percent of the supply fan volume. Louvers between the outdoor air and return air chamber, which permit bypassing return air into the supply fan, are controlled by the return air temperature.

Tenants Decide About Ceilings

The return air ducts are in the corridors. Inlets are provided in the sides of these ducts at intervals, according to whether a floor is one open office space or is broken up into small offices. In some cases, the headroom in the corridors under these ducts had to be reduced to 7 ft, but generally it is 8 ft. In the office areas, where there are only the smaller supply ducts, the head room is 9 ft.

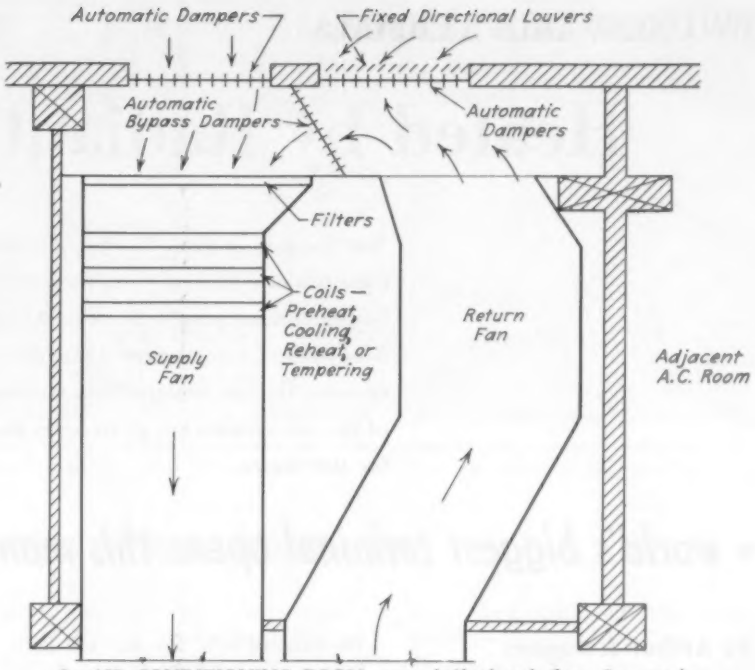
The building owner provided only the ducts and outlets, leaving it to the tenant to decide whether to put in hung ceilings at his own expense. Many of the ducts are exposed.

All Perimeter Spaces Are Zoned

The arrangement of the distributing air ducts is shown on the typical floor plan for one half the floor, the other half being the same arrangement in reverse. The exterior wall spaces are all on separate zones, each thermostatically controlled through the positioning of air volume dampers to allow for sun and wind exposure. The interior spaces remain under the control of the return air temperature. This permits flexibility in both heating and cooling.

Outside Air Cools Interiors

The interior spaces — with their low heat loss in winter and their greater heat gain in Spring and Fall due to occupancy, lights, and equipment — can receive up to 100 percent outside air without overcooling the perimeter spaces, and can be kept at proper temperatures without the use of refrigeration. The result is many fewer hours of operation of the compressors.



3 AIR CONDITIONING ROOM serves half of each floor. Louvers between the outdoor air and return air chambers, which permit bypassing return air into the supply fan, are controlled by the temperature of the return air

Air Units Provide Flexibility

Having individual air conditioning units on each floor has proved advantageous in several ways. In a commercial office building, especially one where whole floors — and often several floors — are taken by one tenant, it is impossible to forecast what the requirements of these tenants will be. Density of occupancy, lighting load, amount of machinery, and partitioning vary widely from tenant to tenant. With air conditioning rooms on each floor, there is provided flexibility to meet a variety of conditions which would be difficult with many other systems.

In this particular building, it was found that during the winter, when the outdoor temperature is above freezing — which it is most of the time in New York City — the interior spaces on the upper six floors overheat and require cooling. Of course, they can be cooled very easily because the percentage of outdoor air on these floors can be increased up to 100 percent, while the thermostatic control of the volume dampers in the ducts to the perimeter areas keeps those spaces at proper temperature without getting too cool.

Heating Cost Reduced

The net result has been not only good control of both temperature and humidity throughout the building but an actual reduction in the cost of heating the building after air conditioning was installed. This is true in spite of the larger volume of outside air used. Part of the reduced heating cost may be attributed to proper balancing of the water flow to the radiators and in part to the improved control, manually, of the flow — according to the demand for heat — and finally to the control of window ventilation made possible by the new ventilating fans used for the air conditioning system. The heating cost was reduced from about $40,000 to $33,000 for a year as a result of all these improvements when the outdoor temperature was normal.

The air conditioning installation was done by Kerby Saunders, Inc.

TWO NEW AIR TERMINALS

Heated by Radiant Panels

New hangars at both Chicago's O'Hare field and Trans-Canada's new Malton, Ont., terminal are equipped with hot water floor panels. The entire floors, as well as door aprons, are integrated into completely balanced systems. Design, construction, and operating details of the two systems are given here, along with the reasons for the choice.

• *world's biggest terminal opens this month*

By Arthur J. Rogers

Reliable Heating Co., Heating Contractors

ECONOMY, uniform heating, and quick recovery were main reasons for installing a hot water panel system in the first of several new hangars for Skymotive Aviation Management Corp. at O'Hare field, Chicago International Airport, which opens this month for commercial use.

To be the world's biggest airport when finished, the 6393 acre field will ultimately have six 8100 ft long runways fanning out in a spoke from the terminal hub. The hub will have 96 passenger and freight gates for as many standing aircraft. Named in honor of Lt. Cmdr. Edward H. "Butch" O'Hare, World War II naval ace, the 10 sq mile field is expected to become the world's busiest.

Eventually, all aircraft will be fueled by an underground piping system from gasoline storage tanks with a total capacity of 800,000 gal.

The panel heating system for the first hangar completed was designed in three sections, one for each bay in the 60,000 sq ft hangar. The calculated heat loss of the hangar under design conditions was 6 million Btu per hr. This permitted the design of the panels to be based on a heat release rate of 100 Btu per hr per sq ft.

THREE-BAY HANGARS at O'Hare field have three sections of heating panel, each with five separately controlled circuits. Laid on 3½ in. thick crushed stone bed, piping was covered with 6 to 9 in. thick concrete, depending on the load

Floor Panel Has 15 Zones

The water supply is distributed by three 3 hp circulating pumps. Each pump is controlled by its own outdoor control and supplies water through a 3 in. main to five grids. The 124 ft long grids are made up of ¾ in. steel pipe joined at each end by a 1½ in. manifold. Fifteen of these grids control the entire hangar and are so designed that any of the 15 zones may be isolated without disrupting the system.

All pipe was welded on the site. Approximately 3200 pipe welds were necessary for the entire network.

Depth Varies from 6 to 9 in.

Pipe coils were installed on a crushed stone base 3 in. thick. Concrete covers the coils in thicknesses from 6 to 9 in., depending on the load carried. Spacing between pipe coils is 9 in. between centers under door rails, 12 in. between centers around the perimeter of the structure, and 18 in. between centers in the central part of the hangar, where the heat loss is mainly downward.

TWENTY BANKS of 1¼ in. galvanized steel pipe each contain three sinuous coils with individual return piping. A regulating valve and thermometer for each return pipe provides flexibility for balancing the system

• huge panel keeps hangar warm, dry

By R. B. Campbell
Design Engineer,
A. D. Margison and Associates
Toronto, Ontario

FOURTEEN MILES of galvanized steel pipe are embedded in the concrete floor of the new Trans-Canada Air Lines hangar at Malton, Ontario, which gives a radiant heating panel over 124,500 sq ft in surface.

This new concept of hangar heating, when previously incorporated by our firm in maintenance hangars for the Royal Canadian Air Force's postwar expansion program, has given extremely satisfactory results. A radiant heating floor slab proved the answer to the problem of heating a building with a high roof and with the workers at floor level.

The hangar, which is used for line maintenance and service, comprises the hangar proper and an adjoining annex, which is one-fourth the total area. The annex, of reduced story height, houses workshops, offices, boiler room, equipment room, and storage rooms. The boiler room and the equipment room are in the center of this section.

In addition to the radiant heating panel, unit heaters are utilized for

(*Continued on next page*)

No edge insulation was installed in the footings or under the slab. To minimize the heat loss through the edge, a concrete border of 4 ft was provided with no pipe coils around the hangar, except on the front where the large doors are operated.

Each bay contains five circuits. Manual valves permit shutoff of any circuit without influencing the others. A new type of shutoff valve, developed for this installation, is flush with the concrete floor surface.

The system is operated under a pressure of 20 to 25 psi. The range of water temperatures entering the panels is from 80 to 140 F, depending upon the heating load.

Hot water is supplied to the floor panels from a converter suspended on the back wall of the hangar. The pumps and expansion tanks are also grouped at this central point for efficient operation and maintenance.

The converter receives steam through a 2 in. line from a 5 in. main from the central steam plant. A 5 in. gate valve at the hangar wall where the steam line enters permits the complete shutoff of the steam. An expansion U bend for the steam line and the 2 in. condensate return line was fabricated, insulated, and placed underground just outside the hangar wall.

Three Outdoor Controls Needed

The system is controlled by means of three outdoor controls on the north side of the hangar. These controls operate motorized valves in the hot water line and pumps for each section. The room thermostat mounted on one of the two columns in the central area of the hangar serves only as a high limit control.

The hangar also contains a second floor office area of 50 × 180 ft, with shop space directly below. Baseboard convectors heat these areas.

Lundstrum & Skubic were the architects and engineers, and G. J. Rassas Construction Co. was the general contractor.∓

FLOOR-FLUSH VALVES, manually operated, permit shutoff of any circuit without affecting others. Piping network required 3200 welds

• panel heating system sized for 40 percent expansion

supplementary heating of the hangar proper. The annex is heated by finned radiation and unit heaters.

The hangar proper is 817 by 152 ft, with an average clearance height of 53 ft. Five telescoping canopy doors, on opening, virtually remove one wall along the entire length of the hangar, giving a clear height of 44 ft. Inside the hangar, space is unobstructed from wall to wall and from floor to roof truss. Theoretically, the hangar is divided into five bays, each bay serviced by one of the hangar doors.

40 Percent Expansion Provided

The radiant heating system is designed to operate with a maximum floor temperature of 82 F, with a return water temperature of 110 F when the outside air temperature is at −10 F. An electronic control system automatically regulates the temperature of the circulating water leaving the steam-to-water converters according to the rise or fall in outside air temperature.

Three converters and three centrifugal pumps with a total capacity of 1125 gpm are utilized to heat and circulate the water for the system. With the present heating capacity, one pump and one converter can be used as a standby, since the system is designed for a 40 percent expansion of the existing structure. The only addition to the heating system needed would be the radiant heating pipes and headers.

The 1¼ in. radiant heating coils are embedded 2½ in. below the concrete surface. Designed for airplane loading, the floor required no special construction for the installation of radiant coils. The galvanized pipe was set on prefabricated metal stools at 18 in. centers, with reinforcing steel above and below the coils.

No insulation was applied between the floor slab and the ground except at the perimeter of the slab, as the greatest heat loss from a floor slab to the ground occurs at the perimeter of a building. In this case, the heat loss from the floor was not a prime consideration, as the ratio of the perimeter to floor area is small.

The radiant piping consists of 20 banks of coils extending across the length of the hangar. Each bank contains three sinuous shaped coils with individual return piping. Each return pipe is provided with a regulating valve and thermometer which give adequate flexibility for balancing the system.

Unit Heaters Add to Input

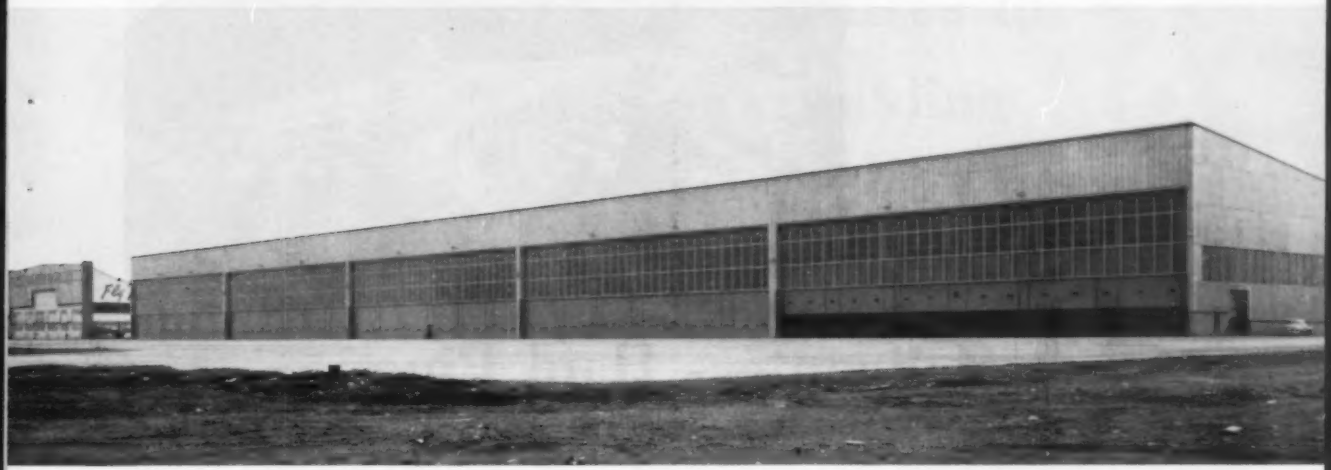
Unit heaters supplement the radiant heating system which supplies half the heating capacity required for the hangar proper. The unit heaters are divided into three groups, for three separate functions:

1) Three unit heaters in each bay are utilized for heating the area near the telescoping doors to give a fast regain. This quickly restores the temperature to 65 F after a door opening and closing cycle. The three heaters in each bay are controlled by a room type thermostat near the hangar door. The thermostats start and stop the fan motors on demand, but an automatic circuit breaker stops the fans for the bank of three unit heaters when the respective door is open. This prevents a waste of heat to the outside atmosphere.

2) A unit heater in each of three

RADIANT PANELS installed 2½ in. below concrete surface supply heat at floor level, keep floor dry, and have a large heat storage effect. Lower dry bulb temperature possible permits fuel saving

FIVE HANGAR BAYS, each with huge door, require several unit heaters apiece for fast regain of temperature, for supplementary heating, and for de-icing aircraft



adjacent bays is utilized to heat the particular bay. Each heater is controlled by a thermostat which operates a modulating valve in the steam line to each unit. The fans on these unit heaters are manually controlled.

3) The remaining two adjacent bays have five unit heaters in each bay mounted in a T-shape. These units are set above the aircraft parking positions and are used for de-icing and warming up incoming aircraft. Each set of five unit heaters is manually controlled.

Floor Slab Heat Storage Great

The great heat storage effect of the radiant concrete floor slab has a two-fold effect on the heating system.

1) The effect of the radiant heat quickly restores the working stratum to a reasonably comfortable condition, even when the large doors have been open for an extended period.

2) The installed boiler capacity is approximately 76 percent of the total heating equipment capacity, which gives a decided saving in intial cost for steam plant equipment. A critical condition would exist when the radiant heating system and the unit heaters demanded steam simultaneously. To avoid such a condition, an automatic control temporarily cuts off the steam supply to the radiant heating system. This control is actuated by a pressure control sensing the pressure in the steam header. The temperature of the floor slab drops very little during an intermittent shutdown of the heat supply. Furthermore, the interruption is short because the unit heaters for the hangar proper are deliberately oversized and restore the hangar to the proper temperature in a short space of time.

In addition to the radiant floor slab's supplying heat at the floor level and retaining a large heat storage effect, it also maintains a dry floor which is essential to the particular type of work done on aircraft. Also, the dry bulb temperature may be maintained at a lower setting and still obtain the same degree of comfort, as compared to a conventional heating system. This affords a saving on fuel costs.

The radiant heating system has been in operation for two heating seasons, and no cracks have appeared in the floor slab other than what would appear under normal use. This is particularly significant as the radiant heating system was started in February when the outside temperature was 6 F. The temperature inside the hangar was 38 F, and the floor slab 40 F. Raw water fed into the coils at 80 F at first returned at 40 F. When the coils were full of water, the circulating pumps were started, and by manual operation the temperature of the water was raised from 80 F to 120 F through 8 F per day. The controls were then set on automatic. Throughout this operation, no cracks appeared in the concrete floor.

The ability of this type of heating system to maintain comfort in the work areas of large hangars has been proved over two heating seasons.

Annex Heated Two Ways

The annex is heated with finned radiation, which is installed below the windows along the outside walls to offset the heat loss through the windows and outside walls. Unit heaters are employed in areas with excessive roof loss or frequent air changes created by the presence of large doors or ventilating units.

The steam generating equipment consists of two Scotch-wet-top, back-type boilers, each with a capacity for a continuous maximum output of 8000 lb of saturated steam per hour at 15 psig. Provisions have been made in the design of the steam plant for the installation of a third identical boiler for future extension of the building.

An induced draft fan exhausts the gases to the atmosphere. Combustion controls are automatic, responding to the steam pressure in the header.

Two 10,000 imperial gal underground tanks provide storage for the fuel oil, which is preheated before combustion. ≠

In mountain areas . . .

Helicopters Haul Pipe

the easy way . . .

THE USE OF A HELICOPTER in hauling pipe for installations, especially in difficult terrain, is receiving increased attention in a variety of applications. 'Copters are being used to transport lengths of steel pipe and coils of plastic pipe for strategic pinpoint dropping and also to lay long sections of rubber pipe.

As early as eight years ago, in a demonstration at the Army Engineer Center, Ft. Belvoir, Va., a helicopter flying at 40 mph at about 20 ft above the ground laid a 400 ft rubber pipe line in 25 seconds. (See HPAC for July 1947.) The hose, folded into a special container, was released by the pilot at the press of a button.

Within recent months, helicopters have been used to carry pipe in the mountains of North Carolina and in the French Alps.

For a huge hydro-electric plant pipe line in the Alps, a helicopter was the only means available for delivering heavy lengths of large diameter steel pipe. There was no railroad, and the roads proved too steep. One section at a time, the pipe was delivered to the remote mountain area.

In North Carolina's Blue Ridge mountains, a helicopter solved the problem of delivering lightweight polyethylene pipe to carry water from a spring high on one peak down the valley and up to a tourist area near the summit of Grandfather Mountain, the highest in the range. According to the Bakelite Co., the plastic pipe, taped up in 500 ft coils, was strapped to the side of the helicopter, flown from a small parking lot to small clearings at 1000 ft intervals along the pipe line route, and dropped to a ground crew who made the connection with the next coil.

In this pipe line, gravity supplies a continuous stream of water at 2 gpm. The water is stored in a 6000 gal tank near the mountain top. ≠

. . . is sometimes the only way

THREE-ZONE CENTRAL SYSTEM

Air Conditions Offices in Factory Type Building

. . . after first season's operation, reduced fatigue and increased efficiency are noted for office employees of the Audit Bureau of Circulations, celebrating its 41st anniversary this month.

YEAR 'ROUND comfort air conditioning recently installed in the Chicago headquarters of the Audit Bureau of Circulations is ready for a review after its first season's operation just in time for the ABC's 41st anniversary.

The 55 ton, three-zone, central system maintains conditions at 72 F and 50 percent relative humidity throughout 22,000 sq ft of office space on the third floor in a factory type building. Among the benefits noted, according to Carl Gazley, ABC's assistant managing director, are cleaner offices, less fatigue, and greater efficiency for the 80 local Audit Bureau employees.

Included in the four exposure suite are perimeter and interior spaces, with large and small offices, a print shop, lunch room, file and storage rooms, and others. The cooling load is especially great on the west side, where large glass surfaces irradiate a lot of sun.

Because of the high load, offices on the west, northwest, and southwest perimeters are all on one zone. Interior spaces and north central offices are on a second zone. And the print shop and related offices on the east side of the building constitute a third zone.

Zone 1 includes the print shop, duplicating room, stencil cutters' room, and proof readers' room. This area receives 100 percent ventilation all the time, with about 5000 cfm of outdoor air.

Zone 2 serves three interior file rooms, storage rooms, and north accounting offices. The air flow rate for this zone is about 5000 cfm also.

Zone 3, in addition to 13 small offices with the high sun load on the west, serves a large office on the southwest and the lunch room on the south. This zone requires 8000 cfm of air. One window air conditioner is also installed in the president's office to handle temporary high loads from smoking and body heat during conferences.

Heating coils are installed in the air handling units to temper the ventilation air in winter. The existing steam heating system will continue to heat the building. The system was sufficiently oversized that steam risers could be tapped to supply the heating coils in the air handling units.

A 50 ft section of the existing ductwork, which previously supplied ventilating air to interior reception and file rooms, was removed. These spaces are now served by ducts from the two new zones.

All the ductwork is exposed. The ceilings, which are 12 ft high, were not dropped because of the expense.

Three zone thermostats control motorized dampers in the ducts to regulate the quantities of outdoor and recirculated air admitted to the units. All air is filtered.

The system is started and stopped manually. A maintenance man employed by the building starts the system at 5 a.m. so that the offices will be at the desired temperature by 8:30. The system is stopped 15 minutes before closing time to help personnel adjust more easily to the outdoor temperature and because the system requires about 15 minutes for proper shutdown. A clock sequence controller is to be installed to provide automatic operation of the equipment. The compressor, with step-up loading, satisfies a variable load.

In addition to the design and operation of the system, the installation procedures are also of interest. From the time the contractor's crew arrived on the job until the system was turned over to the ABC for operation, six weeks elapsed. Although most of the work was done during regular business hours, with only a half-day overtime, there was no disruption of office functions. "So efficient were the design and installation," says the assistant managing director, "that the workmen didn't even get us dusty."

To hoist the condenser to the roof, a heavy duty,

For 41 years the Audit Bureau of Circulations has been a voluntary, nonprofit, cooperative bureau of circulation standards serving publishers, advertisers, and advertising agencies. Seventy trained circulation field auditors scrutinize circulation records of over 2700 publications to determine net paid circulation facts.

HP&AC is proud to show the ABC insignia on its contents page each month. It stands for the confidence both readers and advertisers have in HP&AC's editorial policies and circulation values.

. . . installation during

1 FACTORY-TYPE BUILDING, which houses offices of Audit Bureau of Circulations on third floor, has high sun load on the west

2 OVERHEAD DUCTS are suspended 1 ft below the 12 ft high ceilings. Offices, print shop, and other spaces are divided into three zones

truck mounted crane was used. The condenser was transferred directly from the truck on which it was delivered to the roof top location, where it was mounted on four I-beams.

To avoid disturbing other tenants on floors below and above, riser pipes extending from the third floor equipment room to the evaporative condenser on the roof four stories above were installed in the stairwell. Through concrete 8½ in. thick, and reinforcing rods, holes 4 in. in diameter were cut with diamond drills. Three holes were made in each of four floors and the concrete roof.

Five risers include a 1 in. make-up water line, a 1⅝ in. liquid line, an electric cable, a 2 in. relief line to the roof, and a 3⅛ in. hot gas discharge line. All piping is insulated. A fire dump valve connected to the low side of the compressor discharges the refrigerant to an open vent line to the roof.

Superheat of thermostatic valves was checked with a thermocouple system and valves were adjusted accordingly in post-installation tests.

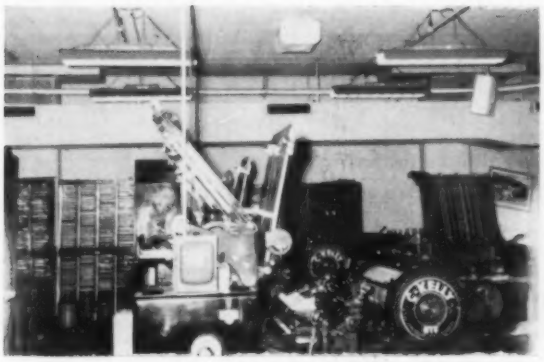
Visible inspection of the refrigerant piping revealed only one leak in a corridor. The refrigerant piping was then double checked for leaks with a sensitive electronic leak detector, using anhydrous nitrogen to build up the pressure. No further leaks were found.

Haskris Co. made the installation. Maintenance of the system is provided in an annual contract with the installing contractor. The system is inspected, equipment is lubricated, and filters are changed every 30 days.≠

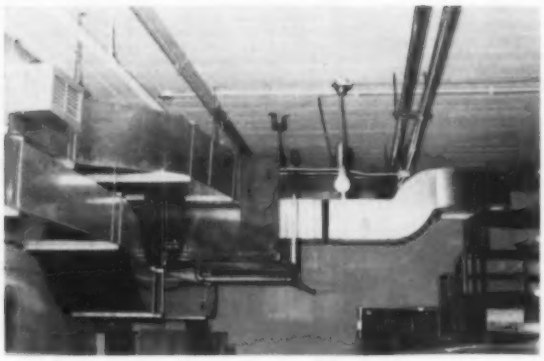
8 TRUCK MOUNTED CRANE hoisted evaporative condenser from truck to the roof, with a great saving of time and work

9 CONDENSER IN MID-AIR moves laterally to roof of seven story building where it was mounted on four I-beams

business hours did not interrupt functions

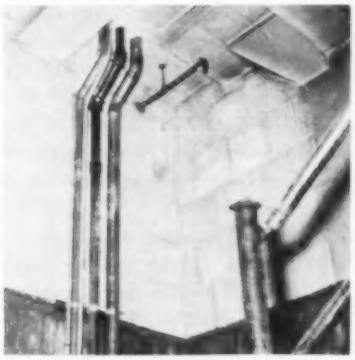


3 ZONE 1, which includes print shop, duplicating room, and related spaces, gets 100 percent ventilation at all times



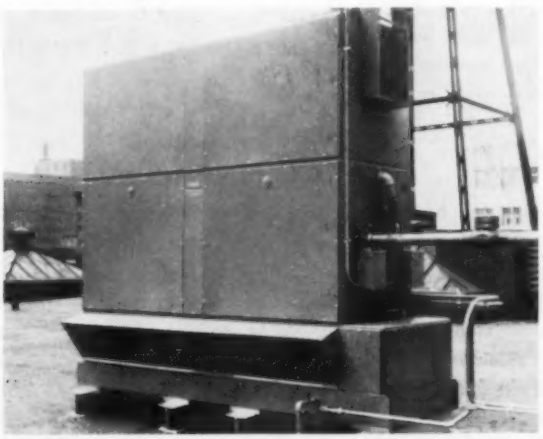
4 ZONE 2 air handling unit, with capacity of 4000 cfm, serves interior file and storage rooms and north accounting offices

5 OVERSIZE STEAM RISERS were tapped to supply heating coils in air handling units

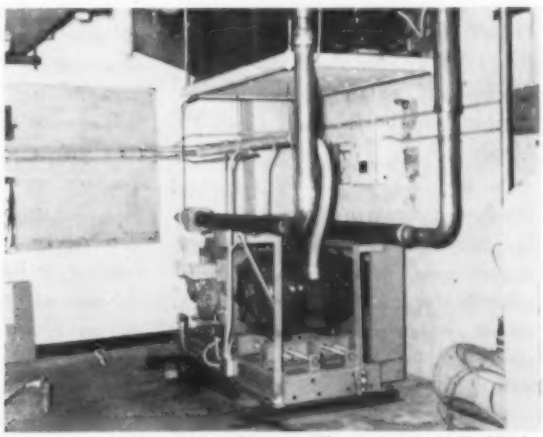


6 FIVE PIPE RISERS were installed in stairwell to avoid disrupting other tenants

7 FIRE DUMP VALVE, connected to low side of compressor, discharges refrigerant to open vent line



10 CONDENSER CONNECTIONS and other lines from compressor required cutting 12 holes through 8½ in. thick concrete floors



Photos courtesy the Haskris Co.

11 55 TON COMPRESSOR is compactly installed in the equipment room, which had an existing air handling unit for ventilation only

New Test Data Simplifies Fluid Flow Problems

. . . in valves and fittings

• Satisfactory solutions to some of the flow problems in the application of valves and fittings to piping systems have been hampered by the lack of comprehensive performance data and by uncertainty as to the proper interpretation of theory. New values of resistance to flow expressed as equivalent length in pipe diameters are given for valves and fittings. The test results discussed here closely approximate observed conditions in the field, says the author.

By E. P. DeCraene

Assistant Directing Engineer
Valve & Fitting Engineering Dept.
Crane Co.

DATA from thorough investigation of friction losses in pipes permits accurate computation of the losses with any fluid through any type of straight pipe.

Figuring Friction Loss

Probably the most generally accepted and most comprehensive information on the subject of friction factors for flow in pipes was published in an American Society of Mechanical Engineers paper in November 1944 by Professor Lewis F. Moody.

In the familiar Moody diagram the friction factors for pipes of varying relative roughnesses are plotted against Reynolds numbers. For very smooth pipes, such as drawn brass tubing or glass pipe, the friction factor continues to decrease with increasing Reynolds number, whereas the friction factor becomes constant at relatively low Reynolds numbers in pipes having a relatively high roughness factor. This zone of constant friction factors in rough pipes has been described as the zone of complete turbulence.

The Moody paper also presented a chart showing the relative roughness of various diameters of common pipe materials. This chart also gives the friction factor for the completely turbulent zone in rough pipes, where the friction factor is constant. Many of the normal flow rates for water and other liquids of low viscosity, as well as for steam and other compressible fluids in commercial wrought iron and steel pipe, result in Reynolds numbers that fall in or near this zone. If it is known that the flow conditions will fall in this zone, the friction factor can be determined from this chart without calculating the Reynolds number.

Numerous tests in our laboratories of varying sizes of clean commercial steel pipe with both water and steam have shown repeatedly that the friction factor agrees precisely with the Moody diagram. Also, friction factors for polyethylene plastic pipe agree with the line for smooth pipes. We have taken some liberties with Professor Moody's diagram and plotted the friction factors for various sizes of commercial wrought iron and steel pipe against Reynolds numbers, as shown in Fig. 1.

The friction factors referred to are values for f in the general flow equation

$$h_L = f(L/D)\ (v^2/2g) \quad \ldots\ldots\ldots [1]$$

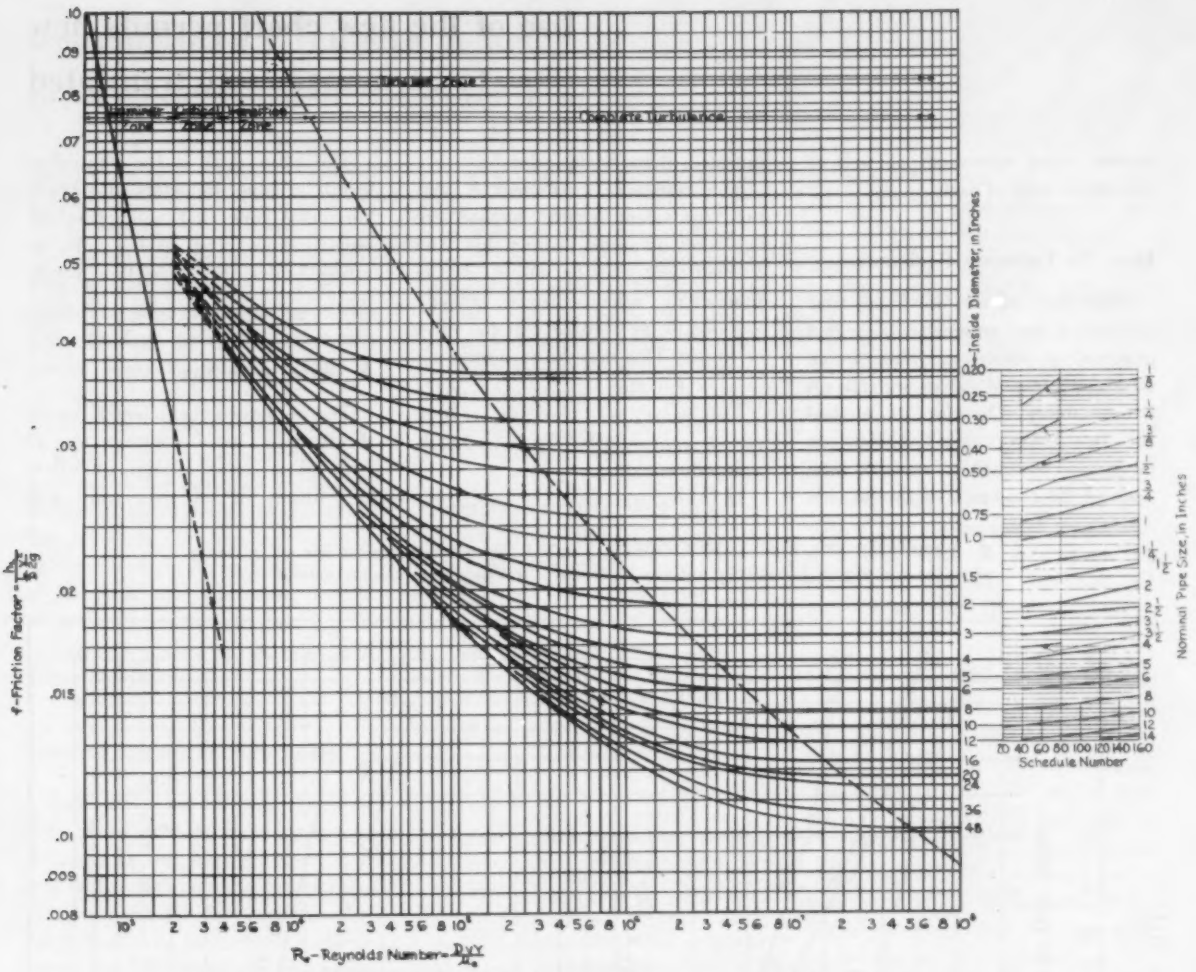
which is commonly known as the Darcy or Weisbach formula.

The value of the friction factor in the Fanning formula — which is expressed in terms of the hydraulic radius instead of the inside diameter of pipe — is equal to one-fourth of the values given in Fig. 3 and in the Moody charts.

Test Pressure Drop

Published information on the pressure losses in valves and fittings is limited. The large variety of valves and fittings, as well as variations in design, make it impractical, if not impossible, to assemble actual test information on the losses in all parts of a piping system. But the situation is not hopeless. By careful analysis of the limited available test data, it is possible to extend its use far beyond the specific items tested.

This article is based on a paper originally presented at the Fluid Mechanics Conference at the University of Wisconsin earlier this year.



1 FRICTION FACTORS for various sizes of commercial wrought iron and steel pipe are plotted here against Reynolds number. Chart is based on familiar Moody diagram of friction factors for varying roughnesses against Reynolds number

Many manufacturers have a program for the investigation of friction losses, as do several research groups and laboratories. Thus, the fund of information is constantly improving.

Size Check Valves Properly

Many difficulties encountered with check valves, both lift and swing types, are due to oversizing, which results in noisy operation and premature wear of the moving parts. Pressure drop varies somewhat for different valve designs, depending upon the relative weight and size of the disc. A good rule is to size lift-check valves so that the pressure drop in the fully open position is about 2 psi, and for swing-checks in the fully open position, about ½ psi.

This rule applies only to check valves designed on the basis of established fundamental considerations which assure a full disc lift at low flow rates. Tests on some poorly designed lift-check valves have shown that the disc will not lift fully, even at extremely high flow rates. In many cases, application of this rule will result in check valves smaller in size than the pipe line, but the actual pressure drop will be little, if any, higher than if a full size valve is used which will not be in the wide open position. The loss due to a tapered reducer ahead of the smaller size valve is partially compensated for by the corresponding tapered increase on the outlet side, so that the added pressure drop due to these effects is minor.

In-line ball-check valves should be installed in a horizontal position wherever possible, because in this position the flow required to move the disc to the fully open position is low, and valves can be full size to match the pipe line. This will result in a low pressure drop at all flow rates, as well as in vibration-free operation. If it is necessary to install this type of valve in a vertical line, it should be sized so that the flow rate will be sufficient to cause a pressure drop of about 2½ psi, which will provide full disc lift and

prevent noisy operation, as well as premature wear of parts.

How To Estimate Resistance

Since tests of this kind are time consuming and expensive, it is not practical to obtain test data on all sizes and types of valves and fittings in use today. Therefore, a method for interpreting the test data to permit a reasonably accurate estimate of the resistance of similar, but untested, items is desirable.

The resistance coefficient K and the "equivalent length" method are two ways of accomplishing this. The K coefficient may be defined as the number of "velocity heads" $(v^2/2g)$ lost due to the resistance of the valve or fitting. This may be expressed as:

$$h_L = K(v^2/2g) \quad \text{.....[2]}$$

The same head loss in straight pipe is expressed by Equation No. 1. It follows that

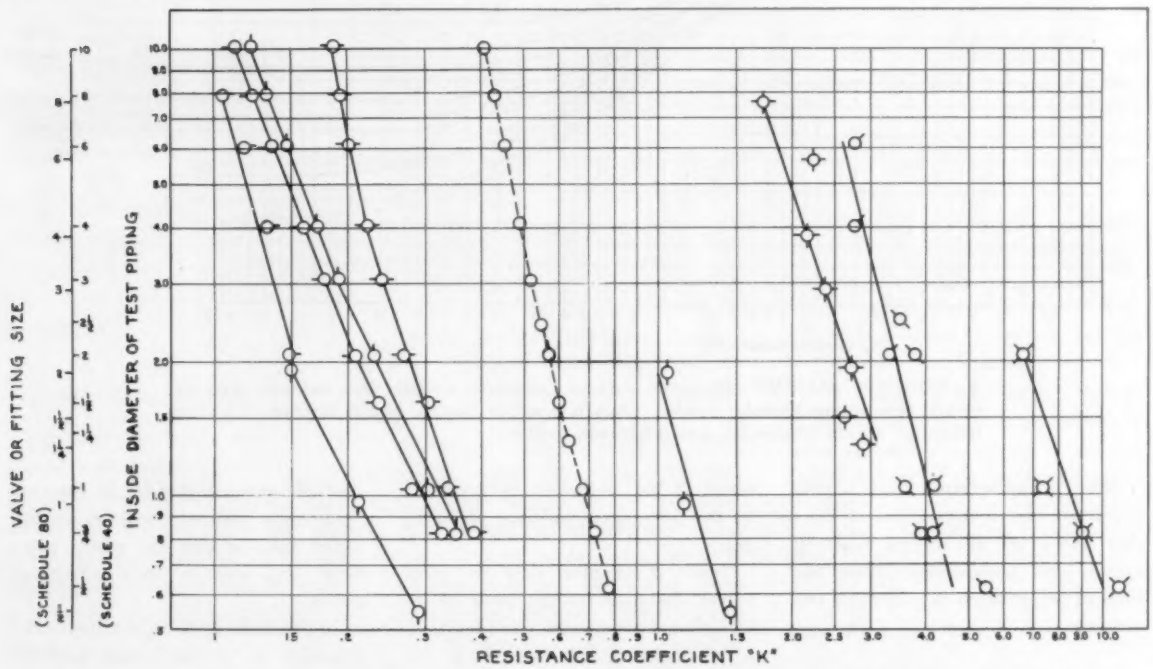
$$K = f(L/D) \quad \text{.....[3]}$$

The ratio L/D is the equivalent length in pipe diameters of straight horizontal pipe that will cause the same pressure drop as the valve or fitting under the same flow conditions.

K Varies with Size

The resistance coefficient K would theoretically be a constant for all sizes of a given design of valves and fittings if all sizes were geo-

2 VARIATION OF RESISTANCE COEFFICIENT K plotted here against size for a variety of valves and fittings is based on analysis of extensive test data from various sources



VARIATION OF RESISTANCE COEFFICIENT "K" (= $f\frac{L}{D}$) WITH SIZE

SYMBOL	ITEM TESTED	AUTHORITY
○	SCHEDULE 40 PIPE, 30 DIAMETERS LONG (K = 30f)	MOODY-ASME TRANS. NOV. 1944
○	125 LB. IRON BODY WEDGE GATE VALVES	U. WISC. EXP. ST. BUL. VOL. 9 № 1, 1922
○	600 LB. STEEL WEDGE GATE VALVES	CRANE TESTS
○	PIPE BENDS R/D = 2	PIGOTT-ASME TRANS.-1950
○	PIPE BENDS R/D = 3	PIGOTT-ASME TRANS.-1950
○	PIPE BENDS R/D = 1	PIGOTT-ASME TRANS.-1950
○	600 LB. STEEL WEDGE GATE VALVES - SEAT REDUCED	CRANE TESTS
○	300 LB. STEEL VENTURI BALL-CAGE GATE VALVES	CRANE-ARMOUR TESTS
○	125 LB. IRON BODY Y-PATTERN GLOBE VALVES	CRANE-ARMOUR TESTS
○	125 LB. BRASS ANGLE VALVES - COMPOSITION DISC	CRANE TESTS
○	125 LB. BRASS GLOBE VALVES - COMPOSITION DISC	CRANE TESTS

test data on a given size or item to any other size of the same design

metrically similar. However, geometric similarity is seldom achieved.

The variation of K shown in Fig. 2 is based on extensive test data from various sources. The K coefficients for several designs of valves and fittings have been plotted against size. The slopes of the K curves tend to follow the same slope as the fL/D curve for straight pipe.

If the evidence presented in Fig. 2 is accepted, the resistance coefficient, K, for a given design of valves or fittings tends to vary with size as does the friction factor, f, for straight pipes. Also, the equivalent length, tends to approach a constant for the various sizes of a given design of valves and fittings.

Internal Diameter Significant

Tests have shown that the pressure drop for a given valve or fitting does not change when it is installed with pipes of the same nominal size but different thicknesses. Small variations in entrance and exit losses caused by mating the valve ends to variable pipe thicknesses, within reasonable limits, are insignificant.

Since the pressure drop is a function of the square of the velocity, and velocity is a function of the square of the internal diameter, the equivalent length of a given valve or fitting expressed in terms of the pipe to which it is connected varies as the fourth power of the internal diameter of the pipe.

For example, if the equivalent length of a ½ in. valve is determined by test to be 100 pipe diameters of Schedule 80 pipe, its equivalent length will be 169 diameters of Schedule 40 pipe, since the ratio of the inside diameters of the two pipes to the fourth power is 1.69. This ratio, of course, varies with the different sizes and thicknesses of pipes. The same relationship applies to the resistance coefficient, K.

In view of this condition, it is general practice for all flow tests to have internal diameters of pipe to coincide with the particular sizes of valves or fittings. For this purpose, the pipes with which the various pressure classes of valves and fittings are normally used have been arbitrarily established as shown in Table 1.

Computation of pressure drop, using equivalent length or K coefficient data established on the basis of this table, should be made using pipe dimensions specified in Table 1; or, for installation conditions not in agreement with the table, the equivalent length or the K coefficient should be multiplied by the resistance correction factor, F_r, when

$$F_r = (d_a/d_t)^4 \quad \text{.....[4]}$$

where

d_a = internal diameter of pipe with which valve is installed, and

d_t = internal diameter of pipe used in test on which equivalent length or K was established from Table 1.

This procedure of obtaining equivalent length or K coefficient data with respect to pipes of varying internal diameters corrects a significant variable that has often been neglected in translating test data. Thus, it makes possible a more accurate prediction of the flow characteristics of untested valves and fittings by comparison of detail dimensions and shapes with tested items.

TABLE 1—SCHEDULE NOS. of steel pipe used in flow tests on various pressure classes of valves and fittings are shown here

Valve or Fitting ASA Pressure Classification (Steam Rating), psi	Schedule No. of Pipe
250 and below	40
300 to 600	80
900	120
1500	160
2500	XX (double extra strong)

These schedule numbers have been arbitrarily selected only for the purpose of identifying the various pressure classes of valves and fittings with specific pipe dimensions for the interpretation of flow test data, and should not be construed as a recommendation for installation purposes.

End Connection of No Effect

Analysis of many tests indicates that there is little, if any, justification for assigning different resistance coefficients to a given valve or fitting with varying types of end connections. The difference between flanged, screwed, and welding ends in this respect has been found to be insignificant. The pressure drop due to unions, couplings, and flanged joints is likewise insignificant.

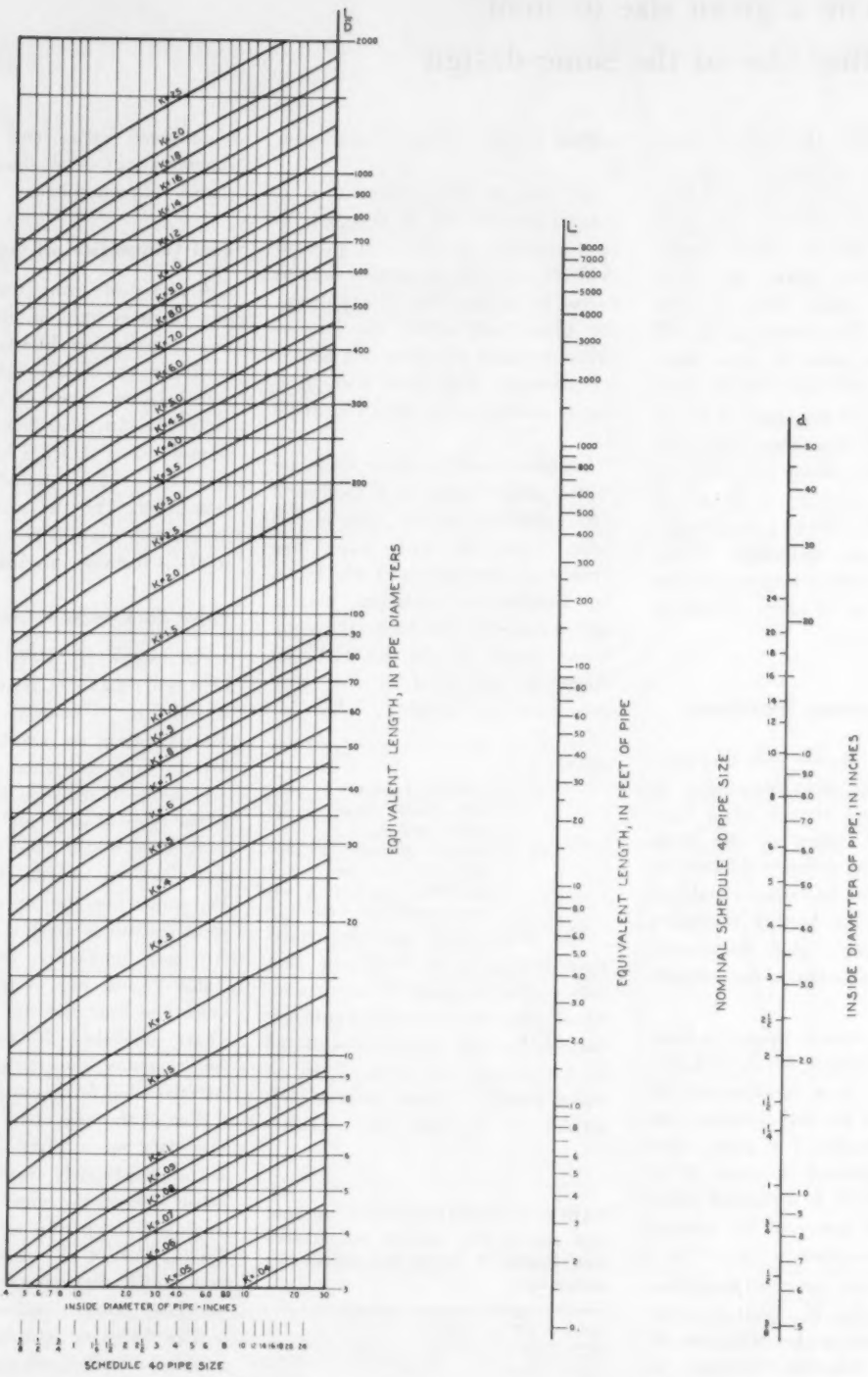
How To Use New Chart

An extensive review of all available test data, summarized in Table 2 and Fig. 3, provides a new tool for estimating the resistance to flow for any piping system. In Table 2 an attempt is made to identify some of the types of globe and angle valves with some of the most common design features, so that the user may be guided in the selection of the most realistic equivalent length value for any particular design. Thus, Table 2 and Fig. 3 together overcome the limitations of the original chart, published 20 years ago by our company, showing the resistance of valves and fittings to flow of fluids.

Use of the new chart permits new test data on a given size or item to be immediately translated to any other size of the same design. The engineer who prefers to work with K factors instead of equivalent lengths can readily determine from the chart the most practical values to use.

The following sample problem is submitted to illustrate the application of some of the foregoing principles:

Problem: 250 gpm of water at 60 F must be pumped through a 5 in. piping system containing 600 ft of straight Schedule 40 pipe, a standard cast iron swing-check valve, a standard cast iron Y-pattern diaphragm



3 RESISTANCE OF VALVES AND FITTINGS to fluid flow at Reynolds numbers over 1000 for any given size or item may be immediately translated to any other size of the same design by the use of this chart

globe valve with stem 60 deg to run of valve, and nine standard cast iron 90 deg elbows. The system discharges into a tank 90 ft above the pump outlet. Find the discharge head required at the pump.

Solution:

1) *Determine if 5 in. is the proper size for the swing-check valve.* (Note: The disc will be less than full open if the calculated pressure drop is less than 0.5 psi, or 0.5 × 2.31 = 1.15 ft head (2.31 ft of water = 1 psi). If this condition prevails, the actual pressure drop will be more than calculated, and slight pulsations in the flow may cause constant bobbing of the disc, resulting in noisy operation and premature wear of the hinge pin and bearings.)

Calculated head loss with a 5 in. swing-check valve:

$$h_L = f(L/D)\ (v^2/2g) \quad \text{.....[1]}$$

where f = 0.019 (Fig. 1, for Re = 156,000)

(L/D) = 135 (Table 2)

$v = 0.408Q/d^2$

$= (0.408 \times 250)/5.047^2$

$= 4.01$ fps

Q = 250 gpm

d = 5.047 in.

g = 32.2 fps^2

$h_L = (0.019)\ (135)\ [(4.01)^2 /(2 \times 32.2)] = 0.64$ ft

The flow rate, Q, of 250 gpm is too low to sustain the disc of a 5 in. swing-check valve in a fully open position. We assume that it is desirable, due to other considerations, to maintain the 5 in. size for the rest of the system. The following calculation indicates that the next size smaller, or 4 in. size, would be fully open at the given flow rate, and the calculated pressure drop therefore reflects the actual service condition. The 4 in. valve may be installed in the 5 in. line with tapered reducers at inlet and outlet without materially affecting the pressure drop. If reducing flanges are used, the additional losses due to sudden contraction and sudden enlargement should be included in the pressure drop. Calculated equivalent length of 4 in. swing-check valve installed in 5 in. line:

$$L/D = 135F_r \quad \text{.....[4]}$$

$= 135(5.047/4.026)^4$

= 333 pipe diameters

TABLE 2—EQUIVALENT LENGTHS in pipe diameters (L/D) of various globe and angle valves and fittings shown here may be used in estimating the resistance to flow for any piping system

Description of Item		Equivalent Length In Pipe Diameters (L/D)
Conventional globe valve with no obstruction in flat, bevel, or plug type seat (fully open)		340
Conventional globe valve with disc guided in seat with wings or pin (fully open)		450
Y-pattern globe valve with stem 60 deg from run of pipe line (fully open)		175
Y-pattern globe valve with stem 45 deg from run of pipe line (fully open)		145
Conventional angle valve with no obstruction in flat, bevel, or plug type seat (fully open)		145
Conventional angle valve with disc guided in seat with wings or pin (fully open)		200
CONVENTIONAL GATE VALVE	(fully open)	13
	(¾ open)	35
	(½ open)	160
	(¼ open)	900
PULP STOCK GATE VALVES	(fully open)	17
	(¾ open)	50
	(½ open)	260
	(¼ open)	1200
Conventional swing-check valve (fully open)		135
Clearway swing-check valve (fully open)		50
Globe lift-check valve (fully open)		Same as globe valve
Angle lift-check valve (fully open)		Same as angle valve
Foot valve with strainer, poppet lift type disc (fully open)		420
Foot valve with strainer, leather hinged disc (fully open)		75
In-line ball-check valve (fully open)		150
Straight through cock with rectangular plug port area equal to 100 percent of pipe area (fully open)		18
3-way cock with rectangular plug port area equal to 80 percent of pipe area (fully open)	Flow straight through	28
	Flow through branch	140
90 deg standard elbow		30
45 deg standard elbow		12
90 deg long radius elbow		20
Square corner elbow		57
Standard tee with flow through run		20
Standard tee with flow through branch		60
Close pattern return bend		50

Calculated head loss due to 4 in. swing-check valve in 5 in. pipe line:

$h_L = 0.019 \times 333 \times 4.01^2/2 \times 32.2$

= 1.58 ft

2) *Determine equivalent length in pipe diameters of complete system*:

600 ft straight 5 in. pipe:

$L/D = 600 \times 12/5.047$

= 1430 pipe diameters

4 in. swing-check valve in 5 in. line

= 333 pipe diameters

5 in. Y-pattern globe valve with stem 60 deg to run

= 175 pipe diameters

Nine 5 in. standard 90 deg elbows, at L/D = 30,

= 270 pipe diameters

or, a total of 2208 pipe diameters.

3) *Discharge head required*:

Head loss due to piping:

$h_L = (0.019)\ (2208)\ (4.01)^2 /2(32.2) = 10.5$ ft

Head due to elevation

= 90 ft

or, a total head of 100.5 ft.

One of the problems for which there is meager information is the resistance of valves and fittings under laminar flow conditions. Flow through straight, horizontal pipes is adequately covered by the basic flow equation

$$h_L = f(L/D)\ (v^2/2g) \quad \text{.....[1]}$$

which is identical to Poiseuille's law for laminar flow when the equation for f in this flow range

$f = 64/\mathrm{Re}$

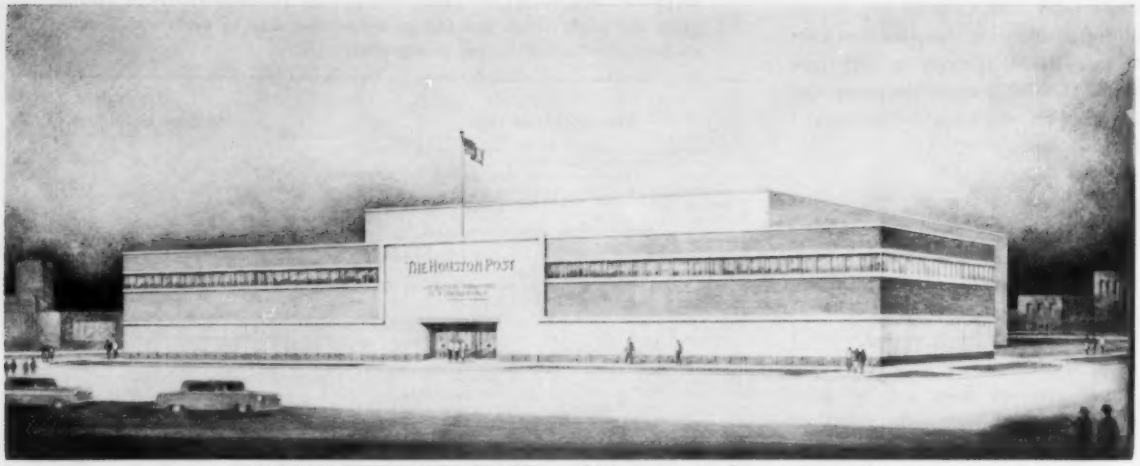
is included in the formula.

For solution of these problems, we have developed, on the basis of data presented in *Principles of Chemical Engineering*, by Walker, Lewis, McAdams and Gilliand, the empirical relationship between equivalent length in the laminar flow region to that in the turbulent region

$$(\mathrm{Re}/1000\ (L/D)_1 = (L/D)_2 \quad \text{.....[5]}$$

where subscript 1 refers to the equivalent length of the valve or fitting in pipe diameters determined from tests in the turbulent flow range — values are given in Table 2 — and subscript 2 refers to the equivalent length in pipe diameters under laminar flow conditions where the Reynolds number is less than 1000.

The minimum equivalent length is the length in pipe diameters of the centerline of the actual flow path through the valve or fitting. While laboratory test data supporting this method is meager, reports of field experience indicate that the results agree with observed conditions. ∓



MODERN NEWSPAPER PLANT combines two story front office section and three story rear windowless plant. The structure is without a basement. Mechanical equipment room is on the first floor in the rear

Houston Post's

Electronic Air Conditioning Control "Rides Herd" on 400 Ton System

• Electronic controls select air and water temperatures, start the gas fired boiler or the refrigeration equipment, whichever is required, for any of the 26 zones. The building cooling load is measured from the chilled water. The water flow rate and the difference in temperature between leaving and returning chilled water are recorded on a strip chart. Instrumentation combines the data to determine the load, and then a system of pneumatic-electric relays operate the equipment to provide close temperature control.

By Charles V. Chenault
Herbert Voelcker and Associates
Architects and Engineers

PART OFFICE BUILDING and part industrial plant, the Houston Post's new plant was constructed last year at a total cost of about $4 million, including the new equipment. Completed in less than 11 months' working time, the 120,000 sq ft building was partially occupied several months before completion.

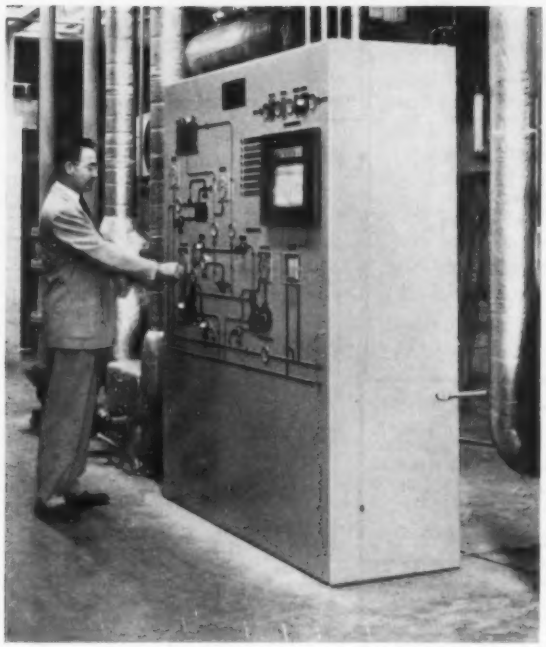
The two story front section of the building containing offices will be extended to three stories in the future. The windowless rear plant area, which is three stories high, has provision for lateral expansion of the press room. There is no basement.

The entire building is air conditioned, including the boiler room.

Present and future cooling requirements, totaling 400 tons, are provided by two hermetic centrifugal compressors, of 150 and 250 hp, respectively. These supply chilled water to 26 zone air handling units, which also receive filtered ventilating air — cooled or heated — from a central medium pressure primary air unit of built-up construction.

During summer operation, the water and primary air are both supplied cold. With outside conditions between 65 F and 55 F, the air is heated, and the water is kept chilled. When the outside dry bulb drops below 55 F, the air is supplied cold, and the water is heated. Some portions of the building require cooling at the winter design temperature of 20 F.

Electronic controls select air and water temperatures and start the gas fired boiler or the refrigeration equipment, as required. Zone units have electronic damper and valve controls. The control system, which measures the building load from the chilled water, selects the small compressor with its chilled water and



CONTROL PANEL with built-in miniature temperature and flow indicators automatically starts, stops boiler, compressors

SUPPLY AND RETURN air ducts, right, control ink mist and paper fuzz in press room and provide cooling air for 90 ton peak load

condenser water pumps, or the large compressor and its pumps, or both machines and all four pumps, according to the load. The control sequence for the central plant requires no human supervision.

Compressors Develop 500 Tons

In the central machine room, the two compressors are so arranged that 500 tons can be developed under extreme conditions. A separate chilled water pump, condenser water pump, and cooling tower fan are provided for each compressor, and an additional pump provides warm water circulation during the heating cycle.

One gas fired, low pressure steel steam boiler of 4 million Btu per hr output provides all plant heating.

The built-up primary air handling unit, which supplies ventilating air for the entire building, except for the press room, is also in the central machine room.

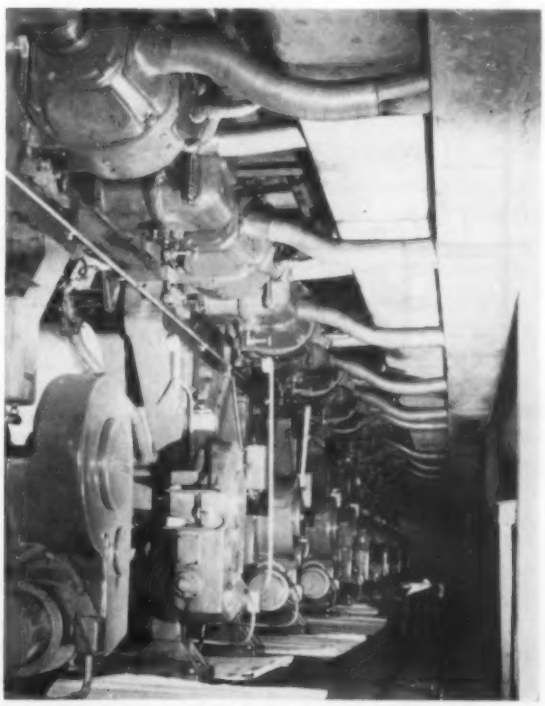
Also located in the machine room are three ink tanks — containing 300 barrels of ink — and ink pumps, which circulate ink through the tanks and to the presses.

Air compressors for the plant are also installed in the machine room.

A motor control center at one end of the machine room contains starters for all remote zone air handling units and principal air conditioning auxiliary motors.

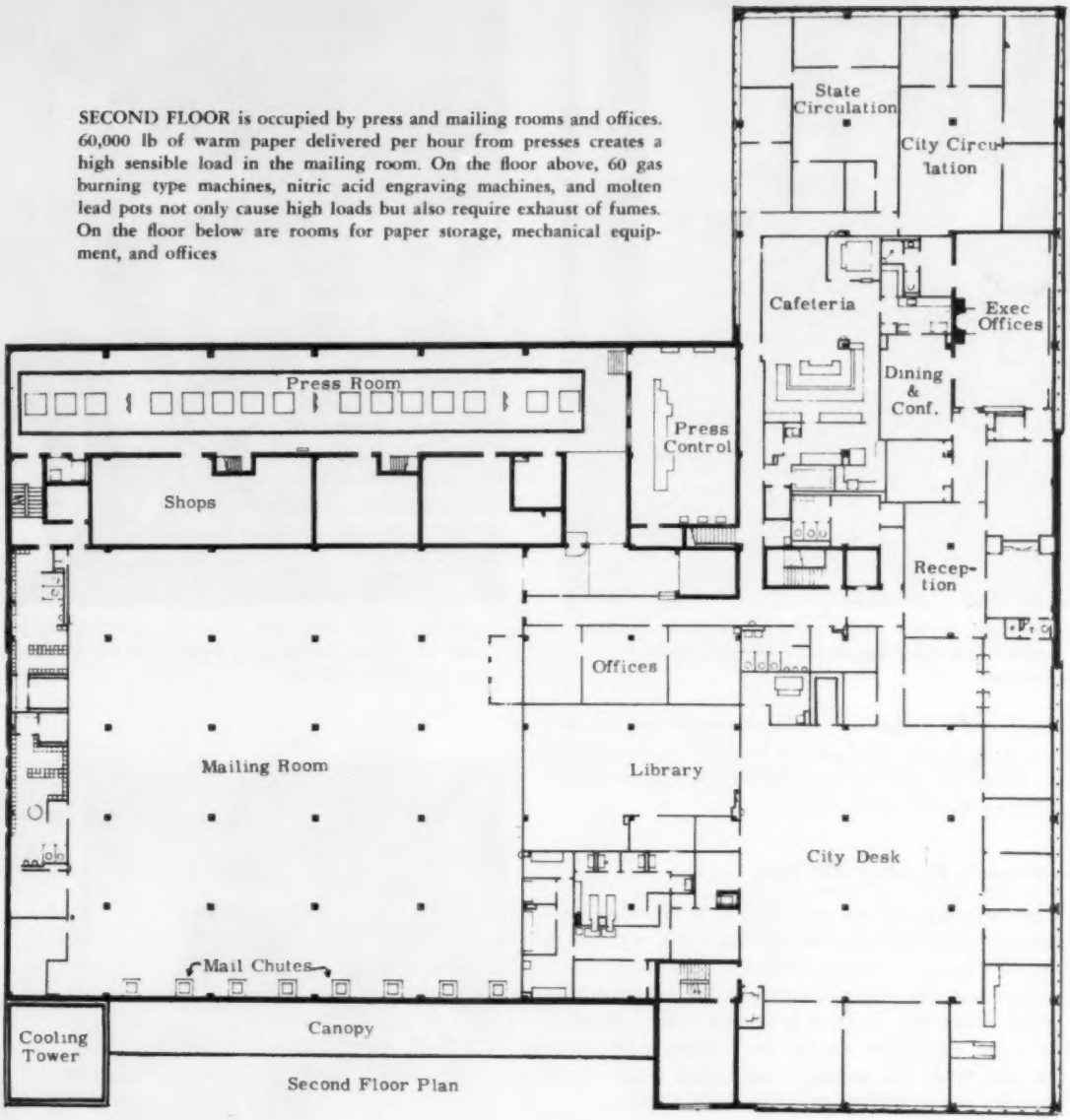
20 Air Handling Units Used

Twenty conventional air handling units provide the cooling and heating throughout the building, using chilled water in summer and warm water in winter. Each of these



FLEXIBLE DUCTS connect supply and exhaust main air ducts to 50 hp press drive motors

SECOND FLOOR is occupied by press and mailing rooms and offices. 60,000 lb of warm paper delivered per hour from presses creates a high sensible load in the mailing room. On the floor above, 60 gas burning type machines, nitric acid engraving machines, and molten lead pots not only cause high loads but also require exhaust of fumes. On the floor below are rooms for paper storage, mechanical equipment, and offices



. . . exhaust fumes and products of combustion

zone air handling units receives a supply of primary air, except for the three press room units.

Snow Melting Coils Serve Dock

The railroad dock at the rear of the building has snow melting coils, which serve in this coastal area to keep the dock from sweating during changeable winter weather. They will probably never melt any snow.

Conventional air distribution serves to cool and ventilate the office section. One office section unit is a multi-zone type, which has four zones. Sheet metal ductwork is in furred ceilings, and most supply outlets are of the ceiling type.

Ducts Exposed in Largest Room

The composing room, on the third floor, is the largest department in floor space and is conditioned by two large units with exposed ductwork. In this department are about 50 gas burning typesetting machines, and type metal casting machines, each with an exhaust connection to remove lead fumes and products of combustion. There are also many saws and other newspaper machinery and an occupancy load of about 75 active employees.

The engraving department, also on the third floor, is provided with an exhaust system connected to the nitric acid engraving machines. This ductwork is constructed of type 316 stainless steel. A variety of operations is provided for in the engraving department, such as photo copy work and photo copy developing, plate stripping, and acid handling. A spray humidifier has been added to the unit in this section and has been found helpful in absorbing smoke from the arc lights.

Molten Lead Ups Cooling Load

In the stereotype department on the third floor are two gasfired lead pots, each holding 10 tons of molten type metal. A casting machine is attached to each end of these pots. Men work around the pots casting semi-cylindrical plates, which are later attached to the printing press. From the closely shrouded top of each pot a duct leads to an exhaust fan in the roof. This exhaust fan also draws air from a large combination hood and radiation shield above the pot.

During operation, used ink covered plates from the press are thrown into the pot through swinging doors, and a great deal of smoke is thrown up and exhausted. Two smaller lead pots are also provided with individual hoods and an exhaust fan. Several mat driers, consuming 4 kw each, contribute to the heavy cooling load in the stereotype department.

Remove Ink Mist, Paper Fuzz

The press room is 25 ft wide, 150 ft long, and has an overall height of 38 ft. The printing press is driven by 18 d-c motors of 50 hp each. These motors are air cooled for cleanliness and cooling load reduction.

The main air conditioning problem in a press room is the ink mist and paper fuzz, which are thrown into the air during high-speed press operation. A secondary problem is the load, which reaches 90 tons at its peak. A total of 45,000 cfm from three air handling units is used.

The ink mist is controlled by supplying this conditioned air above the press from sidewall diffusers and returning the air to the same side at a lower level. Nine surface mounted banks of cleanable ink filters distributed along the length of the press above the operating level receive the dirty air. Ordinary cleanable filters are also installed at each of the air handling units. An exhaust fan draws 5000 cfm from the top of the press room to maintain a negative pressure in the room and to avoid exfiltration to other parts of the building.

Ventilate Gear Room

At the end of the press room on the second floor level is an electrical gear room for the main rectifiers and control sections. This equipment converts 480 volt 3 phase d-c to 550 volt variable direct current for the press motors. The rectifiers themselves are water cooled.

Waste ventilating air from the composing room is filtered and discharged into the control room, then picked up by a blower and used to cool the press drive motors. Ducts collect the air from the motors, which is then discharged outside after being used three times. The air must be clean and free of dust and ink mist to insure reliable operation since the press control equipment contains hundreds of relays and contacts.

Warm Paper Heats Mail Room

Mechanical conveyors deliver papers from the press to a large second floor mail room, where the papers are bundled or wrapped and addressed and dropped into chutes to delivery trucks at the ground level. During high-speed press operation about 60,000 lb of warm paper are delivered to the mail room in an hour, which causes a high sensible load.

Store Paper Near Press Room

A first floor paper storage room adjoins the railroad dock at the rear and connects with the lower level of the press room. Paper is stored and prepared for the press in this section. No humidity control is required for either paper storage or the press operation, but the extremes of humidity in the air conditioned building are not great.

Cooling Tower on Platform

An induced draft cooling tower with two 10 ft diameter propeller fans, driven through gear boxes by 15 hp motors, is on an elevated platform just outside the machine room.

Reheat Circuit Is Unique

The built-up primary air unit handles 23,500 cfm of ventilating air, which passes in succession through cleanable filters, preheat steam coils, chilled water cooling coils, and reheating coils. The reheating arrangement is a unique run-around circuit with an air handling unit in the machine room.

Heat is obtained from motors and machinery in the machine room and is transferred to the primary air stream, so that cooling of the boiler room and reheating are effected simultaneously.

A medium pressure duct system distributes the primary air to all zone equipment rooms.

"Automation" Describes Control

Each air conditioned zone has electronic thermostats, which operate three-way mixing valves on the water coils. In the case of the multi-zone units, face and bypass dampers are operated in addition to a water valve.

The control sequence for the central plant requires no human supervision. Starting with low outside temperatures, the control sequence is as follows:

1) From 25 F to 55 F outside air temperature, the primary air is supplied at approximately 50 F.

2) Below 55 F outside, the water is heated according to an outdoor reset schedule and circulated to the building by a heating pump, which is separate from the chilled water pumps. Ventilating air cools the interior zones.

3) Upon a rise to 55 F outside, the heating pump is cut off, and the small chilled water pump starts. In

five seconds the small condenser water pump and the 150 hp centrifugal machine start. Water is now supplied at 46 F to all zones, and primary air is heated and supplied at 85 F. Interior zones are cooled by chilled water, and exterior zones are heated by primary air.

4) Upon rise of outside air to 65 F, the water continues to be supplied at 46 F, while the primary air is cooled and reheated to 65 F. The boiler automatically shuts down at 65 F outside.

5) With increasing outside air temperature, the building cooling load increases. The chilled water flow and the difference in temperature between leaving and returning chilled water are measured and are recorded on a strip chart. These two pneumatic signals are combined by the instrumentation for a load measurement and as a result, a system of pneumatic-electric relays is operated.

6) When the load reaches 160 tons, the 150 hp machine and its auxiliary pumps stop, and the 250 hp machine starts with its auxiliaries and carries the load.

7) When the load exceeds 275 tons, the small compressor and its pumps are brought back into operation and carry three-eighths of any load of 275 tons or more.

8) Upon a drop in load and outside air temperature, the system unloads and backs down through the entire schedule to full heating. The changes in refrigeration machine operation are set up to keep the operation in the most efficient range of equipment consistent with a low incidence of stopping and starting of equipment. Chilled water temperatures are taken electronically and in some cases are converted to pneumatic signals.

Most of the instrumentation is housed in a large cabinet with a graphic depiction of the mechanical system on the front. Miniature thermometers and flow indicators are at pertinent locations. Pumps, compressors, fans, coils, and heat exchangers, and other equipment have graphic symbols with pilot lights to indicate which are in operation.

A 12 point strip recorder makes a continuous record of the important temperatures in the system.

This control system is expected to pay for itself in the first year of operation, through better use of plant personnel and in power savings. The building is in use 24 hours a day, since the paper is a morning paper.

The owners, whose requests led to the high degree of control, are pleased with this automation. Equipment and controls designed and made available in the postwar period permit full automatic operation of a system this size.

The author wishes to express his appreciation to Mr. S. E. Buttrill, production manager for The Post, for technical information concerning the problems of newspaper plants.

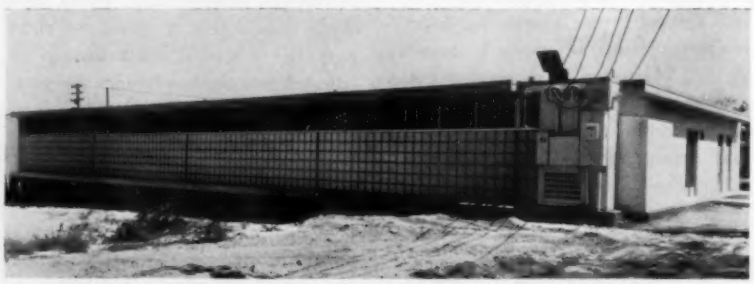
The system was installed by the Wood-Leppard Air Conditioning Company.

Unusual Air Conditioning System Cools, Heats New Medical Center

A SUB-FLOOR PLENUM for return air and an unusual zone system are features of the all year air conditioning installation in the new Olmos Medical Center, San Antonio, Texas, according to the United States Air Conditioning Corp.

Cooling and heating are provided by a 25 ton, self contained central air conditioning plant and two duct type gas fired unit heaters for the one story building containing 48 doctors' offices and treatment rooms.

The compact cooling unit, which contains all of the elements of a central plant, including evaporative condenser, occupies an indoor equipment room, from which two main supply ducts lead to the two building zones on the south and north. Each room receives its conditioned air through a two-way high-wall discharge, accomplished by the utilization of dual deflection diffusers equipped with volume control. Winter heating is accomplished with the same system. A minimum of additional space is required by a duct type heater for each main supply duct.



RETURN AIR GRILLES from the building's 48 rooms and hallway lead directly to the plenum which extends under the entire floor area of the building. All glass wall along entire southerly exposure creates varying demands for heating and cooling throughout the building. Motorized dampers proportion the supply air to two zones according to heating or cooling needs

Return air intakes from the 48 rooms and the hallway lead to the return air plenum, which extends under the entire floor area of the building. In the equipment room, the return air is picked up in a chase leading to the air conditioning unit.

Under the control of two individual wall thermostats, each serving one side of the building, the total capacity of the air conditioning unit is proportioned to the two zones according to the load requirements. Overall temperature control is effected by a third thermostat in the return air stream at the unit.

District Heating Systems Expand

- **Extensions to serve new and future buildings, as well as new customers in existing buildings**
- **Steam plants being upgraded to supply more high pressure steam**
- **Expansion loops being replaced with corrugated expansion joints**

By John F. Collins, Jr.

Secretary-Treasurer, National District Heating Association

EXPANSION AND MODERNIZATION of district steam heating systems were notes sounded repeatedly at the recent annual meeting of the National District Heating Association in Chicago. This was especially true in the areas of distribution, campus heating, steam station engineering, metering, and research.

Two New Mains Serve Pittsburgh

In Pittsburgh the first three of the new Gateway Center office buildings are in use and have been connected to the steam distribution system of the Allegheny County Steam Heating Co., it was reported by William E. Lucas, betterment engineer of that company.

A fourth building — the Pennsylvania State office building — is under construction. The new steam line extensions were made large enough to serve these and the four future buildings, representing a total load of 200,000 lb per hr.

The utility has steam available at 125 and 20 psi but faces a number of complications, explained Mr. Lucas. As electricity is being generated in a 5000 kw noncondensing turbine, operated by high pressure steam in the company's plant, it is desirable to load the low pressure system first and transmit the balance at the higher pressure.

The positions of the Gateway buildings are such that it is best to use two service mains, the first to serve one existing building and one future building and the other to serve the three remaining new buildings and the three future buildings. The first line will be operated under high pressure at all times, the second can be operated at low pressure for the present, but ultimately it will have to be used to supply high pressure steam. At the present, a new pressure reducing valve will bring steam down to 50 psi or lower which will be used only during extremely cold weather. Since the company ultimately will furnish only high pressure steam to these customers, both lines had to be designed for the higher pressure.

Harrisburg Gets High Pressure

Economics of modernizing the Harrisburg steam distribution system were discussed by Robert H. Swoyer, mechanical engineer of the Pennsylvania Power & Light Co., Allentown, Pa. Parts of the system date back to 1887.

In 1949 a Harrisburg hospital notified the utility that a large addition to the hospital was going to be made. Located 3700 ft from the steam plant and 2200 ft from the high pressure line, the hospital would require steam at 90 psi.

The plant was already supplying steam service to 1100 customers in Harrisburg from its Walnut steam heating plant through two 20 in. low pressure steam transmission mains and one 12 in., 140 psi transmission line, all connected to the distribution system.

The plant had a sendout capacity of 425,000 lb per hr at 140 psi. On its way out, the steam passed either through a 2000 kw back pressure turbine generator or through a pressure reducing valve which decreased the pressure to between 10 and 35 psi. Annual sales totaled 1,100,000 M lb, about half of which went to two large customers who took delivery at the steam plant wall.

Preliminary schemes to supply the hospital addition were reduced to three plans:

1) Extension of the 12 in. high pressure line.

2) Same as Plan 1, except a deteriorated 20 in. low pressure line was to be abandoned.

3) Converting all mains from the plant to high pressure and supplying the distribution system through pressure-reducing valves.

The third plan, which was adopted, involved abandonment of the electric generator. The plans were compared as follows in the table:

	Plan 1	Plan 2	Plan 3
1. Capital cost	$202,000	$173,000	$165,000
2. Annual debits: Labor (turbine operator);			
Fuel chargeable to station generator;			
Fixed charges @ 10 percent	38,400	32,900	16,500
3. Annual credits: Electrical generation	24,500	16,400	
Total annual cost to own and operate	13,900	16,500	16,500
Does plan provide for future system growth?	No	No	Yes
Does plan relieve all present pressure problems?	No	No	Yes

Mr. Swoyer said the company, in its planning, tries to: (1) avoid untimely obsolescence of still usable facilities; (2) correlate fully the reliability of the system components; and (3) avoid overbuilding.

St. Louis Adds 12 in. Line

A study made by the Union Electric Co. of Missouri to determine whether it would be more economical to install a peaking boiler or a new steam supply line in St. Louis to serve 36 blocks — which have a present load of 69,000 lb per hr and a prospective additional load of 65,000 lb per hr — was discussed by Leven D. Gray, steam distribution engineer of the company.

The Ashley steam plant at the northeast end of the steam system is the source of all steam. It is carried to the distribution system in a 24 in. main and a 20 in. main at pressures varying from 150 to 215 psi.

The problem could be solved either by the construction of a 12 in. main five blocks long or by installing additional steam service in the area from a 70,000 lb per hr package type oil fired boiler to deliver steam at 250 psi.

The cost comparison is shown in the following table:

	12 in. Tie-Line	Peaking boiler and connection
Initial investment	$153,000	$233,000
		9,100
Total	$153,000	$242,100
Annual Costs		
Fixed charges	$ 21,400	$ 33,894
Maintenance and operation (exclusive of steam cost)	1,789	3,200
Marginal steam cost above Ashley plant cost		1,750
Total	$ 23,189	$ 38,844

It was decided that since the Ashley plant has ample capacity for present and future loads, additional steam supply from a generating viewpoint was unnecessary and the addition of the 12 in. line was much more economical.

Study Velocities, Pressures

In his paper on the critical velocities of steam flow in pipes, Roger A. Parsons of the Board of Water and Electric Light Commissioners of Lansing, Mich., said that instead of a single critical velocity at which changes in steam flow characteristics occur, there are nine such critical velocities and that research is needed to provide more information.

R. W. Gausmann and F. W. Marshall, engineers of the Indianapolis Power & Light Co., explained to the group how they used the large a-c analyzing board at Purdue university to solve the problem of designing a high pressure steam feeder supplying a low pressure district heating system, a problem too complex to solve by ordinary computation methods.

Paris Extends System

In the closing paper on the subject of distribution, M. Salmon-Legagneur, general manager of Compagnie Parisienne de Chauffage Urbain — the steam utility serving Paris, France — described the system as it is today and told of plans for the future.

He said that they have three present sources of steam: their Bercy station having six boilers capable of supplying a total of 300,000 lb of steam per hr at 300 psi; the "Electricite de France" station having low pressure boilers which can supply 80,000 lb per hr or from the exhaust of electric generators at the same pressure; and the refuse disposal plant in Ivry which can supply 80,000 lb per hr.

The Paris utility has about 25 miles of steam pipes connected to 700 buildings, including many famous theaters, operas, churches, government buildings, stores, schools, hospitals, banks and libraries, as well as plants and factories. Pressure in the distribution mains varies from 75 to 300 psi.

Steam sales to customers in 1954 were 1,200,000 M lb, giving a load factor of about 18 percent, an increase.

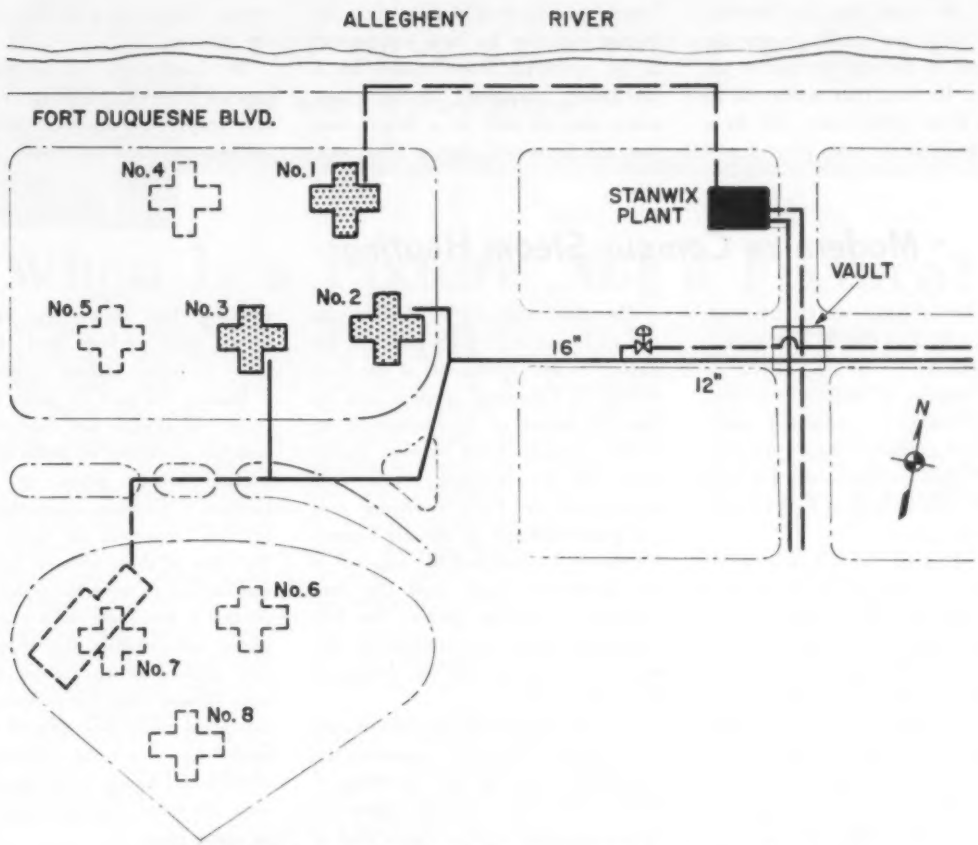
The steam rate, which is set every three months, has been reduced twice in the past five years. The municipal buildings and hospitals are given special discounts. The hospitals are favored if they can supply their own steam during winter peak hours. Condensate meters measure the use of individual customers.

A new steam station and main extension having a capacity of 150,000 lb per hr, in the southwestern part of Paris, is expected to be ready for service in November. Other networks in the northern and eastern parts of the city are planned.

M. Salmon-Legagneur reported that they were replacing expansion loops with corrugated expansion joints to decrease the street space occupied as well as the length of pipe, pressure drop, and heat loss from the lines.

Not all the condensate would be returned from the new extensions, as the present condensate return lines are undersized. A storage tank is to be built to hold excess condensate for later return.

Line insulation is accomplished by pouring expanded mica in the concrete conduits around the lines.



PITTSBURGH'S GATEWAY CENTER steam service lines — designed for eventual high pressure only — are already serving three completed office buildings in the project

• Select Steam Station Equipment for Low Maintenance

THE STEAM STATION ENGINEERING committee, under chairman Walter M. Gillespie, of the Dayton Power and Light Co., presented three useful papers.

In 1950, the predecessor of the Baltimore Gas and Electric Co. installed a low cost, oil fired, integral furnace boiler to serve the district heating peak load in that city. It cost only $2.70 per lb of gross sendout, compared with $8.85 per lb of gross sendout for a conventional, stoker fired boiler having about the same capacity as three of these low cost boilers. Because the single boiler does not have enough capacity to furnish the summer demand, it is placed in operation in the late fall.

Russell C. Hine, assistant to the superintendent of the power production stations of the company, in his paper on the operation and performance of the unit, said that on the basis of maintenance cost per MBtu of fuel fired, expenditures have been a trifle less than half of the comparable expenditures for the best stoker fired boiler over the same period. There have been no forced outages. The principal trouble has been failure of the brick work. However, there is a size limitation which may make it unsuitable in certain locations.

When the Beacon heating plant of The Detroit Edison Co. was built in 1926, two tray type feedwater heaters were included. The increased steam requirements at the plant in recent years made the installation of an additional heater necessary; therefore, a deaerating feedwater heater was put in place in 1954.

In his paper, William M. Dull, engineer of heating plants, explained that a stainless steel spray type heater was chosen rather than a tray type unit because: (1) it was expected that the maintenance cost would be cut 80 percent; (2) it would deaerate more successfully at high loads; (3) a similar heater installed at the company's Willis Ave. plant was successful; and (4) it could be installed more easily, being much lighter and in one piece when delivered.

N. W. Young, of the engineering staff of Babcock & Wilcox Co., spoke on keeping new boiler capital at a minimum for district heating

systems. He said that in defining "initial cost" we really mean the initial cost of our end product to the customer. He said that much can be done to keep initial costs low by a careful analysis of past, present and future load characteristics when selecting capacity for new equipment. If by spending more money on a particular component of the plant, steam can be sold at a lower rate, then the increased cost of that component is actually a decreased cost to the utility.

Mr. Young applied this reasoning to such heating system items as boilers, traps, economizers, deaerators, air heaters, flues and ducts.

• Modernize Campus Steam Heating

THE CAMPUS HEATING COMMITTEE, recently added to the NDHA technical committees — because of the increased number of universities holding membership — presented under chairman George K. Saurwein, formerly of Harvard university but now with the Negea Service Corp., three interesting papers.

In the first of these, Lawrence A. Teasdale, manager of the division of heating and lighting at Yale university told of the use of exhaust steam to cool space. A large percentage of its electric current is made on the campus in noncondensing turbine generators. Two 150 ton and six 25 ton absorption units have been operating for two years on steam at a pressure of 5 psi or less.

The chief engineer of the University of Chicago, J. C. Segeler, in his paper "Steam Operations at the University of Chicago," gave a step by step description of the modernization of the campus steam system, beginning with the building of the new steam plant in 1929. Corrosion and gas pass blockage in the air heaters ultimately necessitated the removal of the preheater plates and the construction of bypass plates. The furnace arch design was altered on several occasions, as was the design of the steel stacks.

Long transmission lines in tunnels were installed in 1929 to connect the new plant with the old distribution system. Since then, the old system has been modernized. Mr. Segeler told of relacing the insulation, expansion joints, and anchors and the steps taken to repair failing welded joints.

During the past 20 years the University of Illinois has conducted several investigations of methods of supporting steam pipes in tunnels. Gordon V. Carlson, superintendent of utilities, reported on these studies. The first of these showed that it was satisfactory to have the roller support contact a sole-plate on a sheet metal jacket surrounding the pipe insulation instead of bare pipe. In 1946 tests showed that the rollers and the sole-plate could be replaced satisfactorily by structural channels and sheet metal bands since the pipe slid over the rollers without their moving in many cases.

• Report Developments in Flowmeters

THE PROGRAM of the Metering Committee sponsored by William G. Gillim of the Consolidated Edison Co. of New York, Inc., consisted of four papers.

Edgar R. Loud, development engineer of Builders-Providence, Inc., described the latest model of a pressure compensated counter. The new model provides space inside the housing for an electric contactor for operating a demand meter, a remote totalizer, or other accessories.

A simple orifice flowmeter that measures the weight of the superheated steam flowing with varying upstream densities was discussed by F. D. Ezekiel, of the Massachusetts Institute of Technology. Such a meter — but designed merely for pressure compensation — has been built and tested with air at various pressures. With an upstream pressure variation from 200 psia to 1200 psia, the pressure drop remained the only indication of the weight rate of flow within a few percent error margin.

The use of a linear flow element as a precision steam flowmeter was discussed by Herbert Goldsmith, chief, research group, National Instrument Laboratories, Inc. Mr. Goldsmith said "that the element is insensitive to upstream flow disturbances, has a uniform readability over its scale range, and is quite accurate for pulsating flow." In test operations, the agreement between the water calibration and the steam calibration was good. Mr. Goldsmith felt that with proper design it will be possible to reduce the nonlinearity to better than one percent.

James W. Althouse, Jr., assistant superintendent of the meter division of the Philadelphia Electric Co., said that the results of their tests were such that he recommended that consideration be given by the NDHA in meter development programs.

Progress in the development of the General Electric Co. mass flowmeter was described by D. S. Cleveland, design engineer in the instrument department of that company.

Mr. Cleveland said that "if a device measures mass flow directly and is inherently insensitive to density and viscosity changes, then it is logical that the higher accuracies are possible." The G. E. meter uses the principle of the conservation of momentum to do this. So far, it has been employed only to indicate a rate of flow of fuel to the engines of jet aircraft. ∓

This article concludes the two part report of the recent NDHA meeting. The first part appeared in the July HPAC.

THE LAW AND YOUR PROFITS

By William Hurd Hillyer

When Is a Fixture Not a Fixture?

THERE's a legal difference between "trade fixtures" and just "fixtures." This difference, affecting the relationships of contractor and owner, purchaser and seller, landlord and tenant, is of importance to heating, piping, and air conditioning engineers and contractors. Two recent court decisions bear this out.

The first case was a chattel mortgage foreclosure action on air conditioning condensers, motors, and compressors housed in the basement of a leased building. They comprised part of an air conditioning system. Under terms of the lease, the tenant was required to provide and operate air conditioning equipment at his own expense. All improvements were to become "part and parcel" of the real estate; but the tenant was permitted to take away all "trade fixtures" which could be removed without damage or injury to the premises.

The tenant, who ran a restaurant, was occupying the property when the lease was signed. Before the lease was signed, the air conditioning equipment, which had been installed sometime previously, was removed, repaired, and renovated at the tenant's order and then reinstalled without damage of any kind to the building.

After the lease was signed, financial difficulties overtook the tenant, who executed a chattel mortgage to an investment company. This covered his restaurant and equipment. As part of the chattel mortgage security, he included the air conditioning unit. The landlord got out a distress warrant and closed the business. The investment company then brought suit to foreclose on the air conditioning equipment. They claimed that such equipment constituted "trade fixtures" and were therefore "chattels."

Not so, protested the property owner, pointing to the clause in the lease, designed to fix the fate of any improvements or additions made to the premises by a tenant. The investment company retorted, in effect: "But the lease specifically reads, 'except trade fixtures'!" The case, therefore, hinged upon whether the pieces of air conditioning equipment in the restaurant basement were trade fixtures or just fixtures.

Testimony was taken before a general master, who reported that the compressor and other machinery, were not trade-equipment-or-fixtures and were not subject to the chattel mortgage. The circuit court chancellor drew a different conclusion, decreeing that they did constitute trade-equipment-or-fixtures and had not become part of the realty and were not subject to the chattel mortgage.

Ruling on the landlord's appeal, the state supreme court enounced a neat formula based on a phrase in the lease, "without damage to the premises." Because the pieces of air conditioning equipment could be — and actually were at one time — disassembled and removed without such damage, "they were trade fixtures and did not become part of the realty." The chancellor's decree, against the landlord and in favor of the investment company, was affirmed.

Reference in the general master's findings to a "stand" on which the compressor and two motors were placed deserves attention. From this it would appear that the air conditioning contractor, who installed the equipment in the first place, had in mind harmless removal and disassembly. Therefore, it might be well to consider the advisability of learning whether clients do or do not want the equipment to be legally attached to the realty and to become a part thereof. Design and method of installation might be governed accordingly. Tax repercussions might also be considered.

The following clear-cut principles were evolved by the court in another case:

1) A fixture belongs to the person to whose land it has been annexed.

2) Whether or not an article is a "fixture" depends upon facts and circumstances of the particular case.

3) Elements of a "fixture" are *annexation, adaptability* for pertinent uses, and *intent*. This third element is of paramount importance. The controlling question is usually whether the intention in annexing an article to the realty is to make it a permanent accession to the land.

4) Intention of the person annexing the article to the realty may be determined from his *acts* and the *surrounding circumstances*, not by testimony of such person or his "secret or undisclosed purposes."

In conclusion, heating, piping, and air conditioning equipment may or may not be a part of the realty, depending upon (a) whether or not it is physically annexed and in what manner; (b) whether or not the units are "trade fixtures" ill adapted to be so annexed; (c) whether their removal would damage the property; and (d) above all, the true intention of contracting or subject parties. ∓

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

QUESTION OF THE MONTH

Can We Group Air Compressors?

THE QUESTION, *How Can We Group Air Compressors?*, was published previously in HPAC and is repeated here along with an answer that has been received. Other comments for publication will also be welcome.

" We would like information which would help us decide on the practicability of grouping air compressors to serve two large industrial plants at one site. At present we have four 2000 cfm, two 1000 cfm and one 750 cfm air compressors in one plant. In the other we have one 2000 cfm and three 1000 cfm compressors.

"We would like to know how we can group all these and their auxiliaries, such as the coolers and receivers, and, also, how to design the piping for such a grouping."—K.F.J.

H. B. WAYNE —

"Use Capacity Control, Insure Air Supply"

WHILE K.F.J. states the number and capacity of the respective machines, he does not indicate if they all operate at the same discharge pressure. Also, he does not indicate the type of compressor drives. The various arrangements of the compressors and their auxiliaries are based on these factors.

The location of a compressed air plant relative to the air consuming areas should be studied thoroughly. Obviously, a central location offers the advantages of unified operation and care, better supervision and possible reduced operating cost. With a central plant, no more compressors need be operating than are necessary to maintain required pressures. This offers greater overall efficiency for the entire installation. Also, with all units located centrally, there usually is more tendency for routine inspection and maintenance without the neglect that is sometimes the case when units are scattered.

In most plants the demands for compressed air varies widely over a period of time and, therefore, some type of capacity control is needed. One form of control is speed and pressure regulation, which varies the speed of the compressor in proportion to air demand. This arrangement is frequently applied to units having variable speed drives, such as direct acting steam compressors, steam turbine, and internal combustion engine driven machines.

Another type of control, constant speed regulation, operates the compressors at constant speed, but varies the capacity by an unloading system. Several types of these are available. This type of control is used where the prime mover speed is constant over the load range as is the case with electric motor drives.

A compressor furnished with automatic starting unloaders permits unloading the unit when starting and stopping. It also allows automatic start-stop control or automatic resynchronizing as the motor voltage drops. In addition, this arrangement permits the use of dual control to allow continuous operation of the compressors with automatic starting and stopping.

Whenever possible, pressure regulators should be installed and adjusted to allow the larger capacity compressors to operate on base load and unload only after the smaller units have shutdown. When the compressed air demand decreases to a value where a smaller machine will meet the requirements, the larger compressors should be shut down, thereby improving overall efficiency of the installation.

In grouping air compressors in the manner proposed, several provisions should be made to insure adequate air throughout the serviced areas. Pipe sizes should be large enough so that the pressure drop between receivers and points of use does not exceed approximately 10 percent of the initial pressure. Piping should be sized not only for present demands, but for estimated future requirements as well.

A loop system throughout the plant buildings is recommended to give two-way distribution to the area with

READER ASKS —

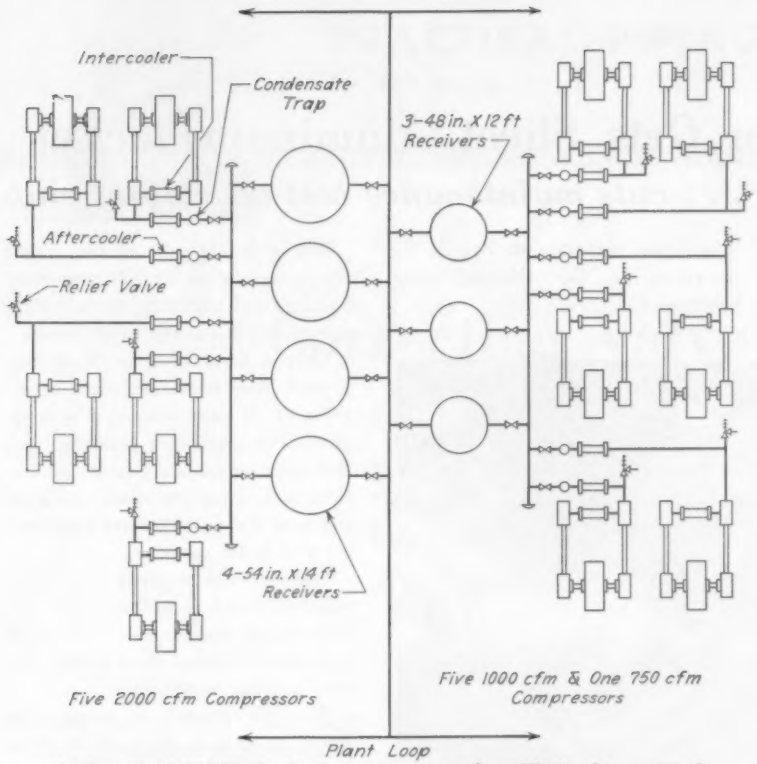
"Why Does Vacuum Heating Pump Clatter?"

"We have a steam driven double acting vacuum return line heating pump that has given noise troubles since it was moved to the boiler room from a room about 160 ft away and 8 ft lower in elevation.

"Previously, when the pump offered no problems, it received condensate from the 15,000 sq ft of radiation by gravity and delivered it up the sloping incline of 160 ft of 2½ in. return line to the boiler room. Now the pump races and clatters at certain times.

"I would like to know what is causing the trouble, and if it can be corrected without returning the pump to the lower elevation."—G.A.N.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*



ONE ARRANGEMENT of air compressors and auxiliaries for a central plant has constant speed, two-stage, motor driven units, all discharging at the same pressure. Note the loop system with necessary valves to supply adequate air where needed

the greatest air demand. Also, with proper valving, a loop arrangement permits passing air to any part of the plant without interruption if a section of piping is out of service. Long lines should be provided with ample sized receivers located at the far ends of the system or at locations where occasional heavy demand occurs. Usually, peak demands for compressed air are instantaneous or are of short duration and by providing storage capacity in the areas where these peaks occur, excessive pressure drop may be avoided.

The piping should be sloped to a drip leg or moisture trap to allow condensed moisture to be removed. The slope should be away from the compressor to prevent condensate from draining back into the compressor cylinder.

Careful sizing and arrangement of receivers are necessary to give satisfactory service. A receiver absorbs pulsations occurring in the discharge line from the compressor. It also serves as a reservoir for storing air to meet sudden demands in excess of compressor capacity. In addition, a receiver will precipitate moisture which may be present in the air as it comes from the compressor or is carried over from the aftercooler.

Table 1 lists sizes of receivers in common use for systems operating between 40 and 125 psig. For lower pressures, smaller receivers may be used, while for higher pressures they should be of larger capacity. The data given in the table is for compressors with constant speed regulation.

TABLE 1—RECEIVERS in common use for systems operating between 40 and 125 psig are listed here by size. Data is for constant speed compressors

Diameter, in.	Length, ft	Compressor capacity, cfm	Receiver volume, cu ft	Relief valves, No.	Relief valves diameter, in.
14	4	45	4.5	1	¾
18	6	110	11	1	1
24	6	190	19	1	1½
30	7	340	34	1	2
36	8	570	57	1	2½
42	10	960	96	1	3
48	12	2115	151	2	3
54	14	3120	223	3	3
60	16	4400	314	3	3
66	18	6000	428	3	3

For automatic start-stop service, the receivers, as listed, are suitable for compressors having one-half the displacement of those shown in the table, so as to avoid too frequent starting.

Illustrated is one possible arrangement of compressors and auxiliaries for a central plant. This design assumes constant speed, two-stage motor-driven units, all discharging at the same pressure. A loop system is shown with required valves to permit the passing of air to any part of the plants if part of the system is out of service. The number and size of receivers is governed by the required reserve capacity, the allowable frequency of starting and stopping, and the cost.—H. B. WAYNE, Consulting Engineer. ⫩

Versailles Palace Gets Central Heating

. . . . oil fired boilers

IN THE Palace of Versailles two huge oil fired boilers are being installed to bring the comfort of central heating to the famous chateau. From the boilers hot water will be pumped to batteries of radiators strategically located in the great basements. Fans will force air across the radiators and into conduits that will carry it into all parts of the chateau.

The heating plant, which is to begin operation next year, will burn 1200 tons of fuel oil a year. The installation is part of a five year plan, costing $2,850,000 annually.

One problem is to convey heat to all the rooms without breaking into wall decorations or paneling.

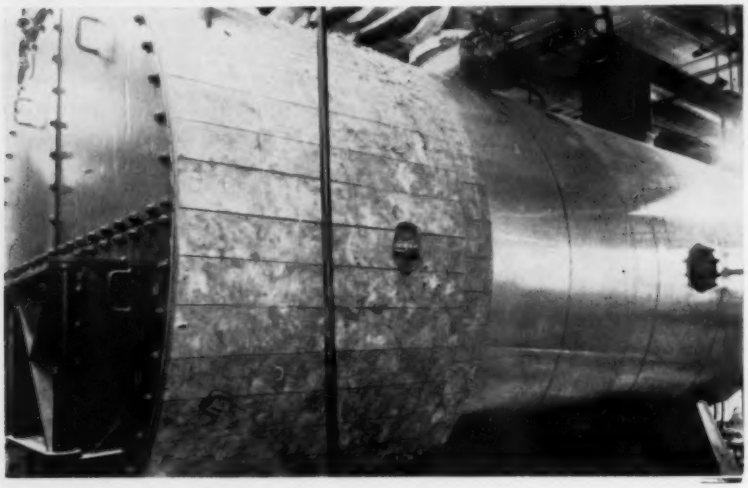
One existing heating plant in the south wing was installed in 1946 to serve the assembly of the French Union. Previous to that, however, the chateau's heating plant was primitive. Cast iron conduits, installed a century ago in the chimneys to circulate warm air in the museum section, soon corroded, began to leak and caused smoke to belch into the heated rooms. ⫩

ON THE JOB

Boiler Insulation Gets Sheet Aluminum Jacket

. . . *cuts maintenance cost at country club*

A NEW TECHNIQUE for insulating boilers was used in the recent installation of a 400 hp steam generator at the Westchester country club, Rye, N. Y., according to the Owens-Corning Fiberglas Corp.



SHEET ALUMINUM JACKET applied to boiler insulation retains neat appearance, cuts maintenance cost

The boiler is part of the system supplying heat to the 300 room main building and adjoining sports lounge, executive offices, and other areas.

Over a layer of 2 in. thick preformed glass fiber insulation, a covering of 20 gage aluminum was applied. The result is a permanent job that requires no maintenance and retains its original appearance, in keeping with the trend toward neat boilers and boiler rooms.

One day was required to place insulation, which is secured with wire cables, and another two days to install the aluminum sheet jacket. The area covered is 401 sq ft.

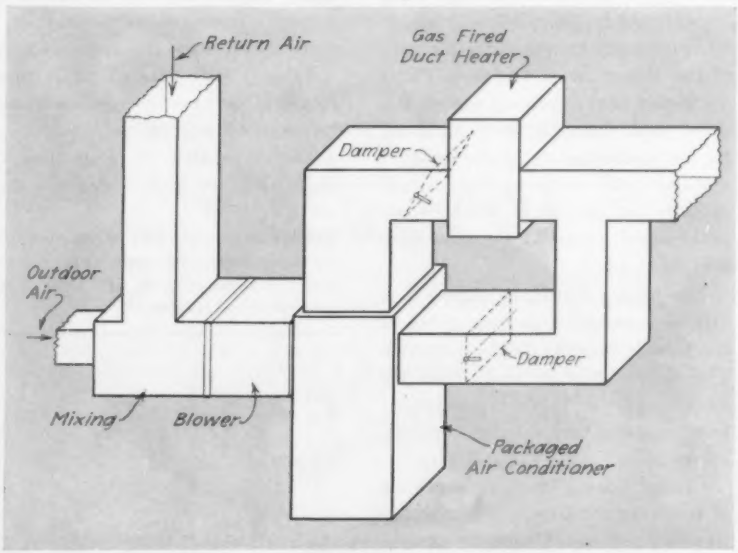
The procedure is to insulate the boiler as soon as it is set in place, before any piping is done. Holes are cut in the aluminum to accommodate all piping. The aluminum sheets are secured by ¾ in. stainless steel bands and seals.≠

Packaged Unit Altered To Serve Multi-Zones

. . . *conditions* 9600 *sq ft*

A CONVENTIONAL upright packaged air conditioner converted to multi-zone operation provides heating and cooling for a new Cincinnati truck terminal, according to the United States Air Conditioning Corp. The blower section of the 15 ton unit is installed at the return air inlet of the cooling section to make it a blow-through unit adaptable to zoning. With the use of a duct type gas fired unit heater, zone dampers and a mixing section, the unit is, in effect, a packaged multi-zone year 'round air conditioner.

The installation in conjunction with a 5 ton packaged unit provides four zone air conditioning for 9600 sq ft of office space.≠



UPRIGHT PACKAGED AIR CONDITIONER converted to multi-zone operation and a separate 5 ton unit provide four zones of air conditioning

PRACTICAL PIPING PROBLEMS

By Bill Dopp

Correcting Valve Cavitation

. . . by drilling a 1/8 in. hole from the bottom of a gate disc to a point adjacent to the seating surface on the low side. Thus, water can flow from the bottom of the disc into the cavitation, breaking it up as the valve nears the closing point. There is no leakage since both sides of the disc are tight.

"I'LL BE DARNED," exclaimed Burt Holden, superintendent of the Black Creek Veneer Mill, as he saw Martin MacVane approaching him. "What in thunder are you doing in this neck of the woods?" Burt asked the genial gasket salesman as he held out his hand.

"I've got an appointment with a few of the fish in the fast water in this neighborhood," laughed Mac, shaking hands. "When I heard over at the hotel that you were out here, I was surprised and thought I'd drop in and see you."

"I'm happy to see you, Mac. Will you come out to the house for dinner? The Mrs. will be happy to see you, too. How are you, anyway?"

"Fine," said Mac jovially. "I'll be happy to see your wife and to lay away some of her cooking. Don't let her go to any trouble, though."

"So you're surprised to see me here?" said Burt. "Well, it is quite a jump from slaughtering and skinning hogs and beef to skinning logs. This doesn't smell quite so much, though. Altogether a different kind of life out here, I can tell you. We've had to learn to get along with what we have here." He turned to the man approaching them.

"No good," the newcomer said to Burt, shaking his head. "Still stopped at the same place."

"Bob, this is Martin MacVane, an old friend; Bob Tuttle, Mac, our engineer."

"Glad to see you," they said, almost together, as they shook hands.

"Mac," exclaimed Burt, "Do you remember the time you got me out of a jam with that 18 in. check valve? Well, we're in just as bad a fix right now. Come on over to the pump shed and take a look at those valves, will you?"

"Glad to help, if I can. Guess the fish'll wait a bit," he smiled.

Can't Close Motorized Valves

They walked through the mill, Mac stopping to watch the thin peeling of veneer being taken off an immense fir log. "Neater than peeling an apple," he declared as they moved on. "What's the particular trouble, Burt?" he asked.

"It's the pump valves on the debarker lines, Mac. We motorized those valves to cut down the labor of opening and closing them; now we can't close them at all. The darn things won't go shut within three-eighths of an inch, no matter what we do." They entered the pump room. "There they are, nice new motor operators. Not worth the bolts they're put together with."

"What's this setup all about?" asked Mac.

"These are the debarker pumps," Bob explained. "They pump water at 2500 psi to the debarkers. The jet nozzles play on the rotating logs. The streams peel the bark off clean, so that none of it gets into the veneer machines. It's a home made outfit, but it works."

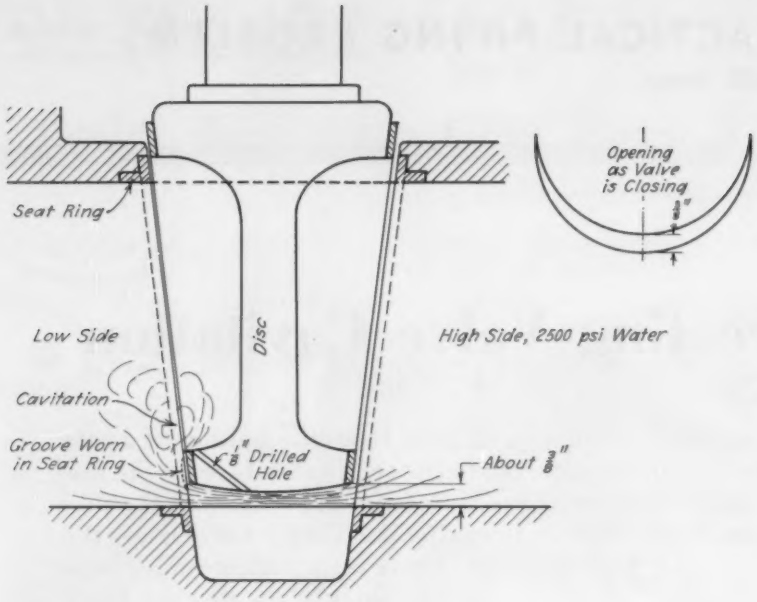
"What turns the logs?" asked Mac. "The jets?"

"No. Another contraption does that. It's gone haywire lately, too. Haven't had time to look into that while we have been fussing with these darn valves."

"What's the matter with them?" asked Mac, studying the motor operator. "That operator should do any work you want it to, if you told the maker how you wanted to use it."

Bill Dopp has had some 40 years of experience dealing with piping, including a long stretch as a sales engineer. He is devoting part of his present leisure to writing of his many piping experiences. All the names used are fictitious.

". . . that valve



VIBRATION AND CAVITATION caused by a 2500 psi thrust of fast water through a motor operated gate valve created a combined friction and pressure load too great for the motor operators. The motor operators could not close the valve until cavitation was relieved by drilling the small hole

"We did that," declared Burt and Bob together. "You see, Mac," said Burt, "they have always shut down these pumps when they wanted to stop the debarker. Sometimes a log gets jammed or the bark piles up, and we have to stop to unscramble things. Bob and I decided that stopping the pumps was a darn nuisance; so, we put a 1½ in. relief valve ahead of the 4 in. gates, set it at 2600 psi and carried the discharge back to the suction side of the pump. Then, when we close one of the gates, the pump keeps running until we open up again."

"Pump motor tend to get hot?" asked Mac.

"We seldom let the pump run that way very long," answered Burt. "We've had no trouble with the pumps."

"What happens to the valves?" Mac had a puzzled frown. "You say you closed them. I thought you couldn't get them closed?"

"We used to close them by hand," said Bob. "That's what we called it, but it took two huskies with 4 ft bars on the handwheel to get them either open or closed." He chuckled, "Brother, that was some job! It didn't take us long to decide to put on motor operators."

"And you told the motor people all about what you were doing with those valves?" Mac eyed the two shrewdly.

"You bet we did, Mac," asserted Burt. "After we set the torque limit switch up as far as it would go and the valve wouldn't close, we wrote them. They said there must be something in the valve. We knew they were nuts, but we took one of the valves apart. Did we get a surprise!" He took Mac by the arm. "Come, let me show you."

Find Disc, Seat Ring Scored

As they got to the bench, Burt picked up a valve seat ring, handing it to Mac with a grin. "That's what we found in those valves." Mac took the ring, examining it carefully. Running his fingers over the surface, he frowned at the depressions he found at two places on the seating surface. He looked inquiringly at Burt.

"Those two worn spots," said Burt, "are near the bottom of the valve. You can see that they are opposite each other. The lower edge of the disc was worn on the down side, where the edge of it had dug into the seat ring."

Mac looked questioningly at Bob. "As we figure it," said Bob, "the pressure forced the disc up against the low side seat ring and wore that depression or groove into it. Then when we got the motor on, the disc would stick in the groove and stop the motor."

"Didn't you look at the valves when you put on the motor operators?" asked Mac.

"The valve company sent us a new stem and yoke and the machine," replied Bob. "All we had to do was to take off the bonnet and raise the disc to take out the old stem. We put the new stem into the disc, made the assembly, and closed up the valve." He shrugged. "Never dawned on us that there could be anything wrong with the valve itself."

"Do you know, Bob," interrupted Burt, "we should have suspected something when they quoted that motor operator. Do you recall that they said they would take no responsibility for the thing working, since they could not tell anything about the condition of the valve that we would apply the motor operator on?" He grinned at Mac. "That should have warned us."

"Those valve boys generally know what they are doing," asserted Mac. "You see, a motor driven disc does not seat itself in the same place or in the same way as a hand driven disc. In the one case, you have a steady application of power and a continuous movement of the disc, while in the other you get a jerky,

will close tight, but not with pressure on it."

uneven application of power." Mac pointed to the seat ring. "This must have been done while you were operating the valves by hand. How long did you do that?"

"About three months, maybe four," answered Bob.

"What did you do when you found this?" prompted Mac.

"We put in new seat rings, smoothed up the bottom of the disc, and put the valves together again." Bob waited for another question. "And now the darn valves won't close within three-eighths of an inch, anyway," he added disgustedly.

Mac looked the setup over thoughtfully. Each of the pumps had a motor operated gate on the outlet. The lights on the panel were both red, showing both valves open, although one of the pumps was not running. He turned to Bob. "I'd like to see the inside of one of those valves. You've got the chain hoist hooked up. Would it be too much trouble to open that gate on the dead pump?"

"Nothing is too much trouble if you can find the answer to this problem, Mr. MacVane. We'll get to work on that right now." Bob hurried away.

"Got an idea?" questioned Burt hopefully.

Mac shrugged his shoulders. "What about this other contraption? Let's see it."

Prevent Weights from Swinging

"Sure," agreed Burt. "Come on." He led the way to another part of the mill. They could hear the rushing water as they approached the debarker. Bark and spray were flying in all directions behind the heavy screens. At one side, an operator was working a handle that looked like the standard gear shift on an old fashioned automobile. This fellow seemed to be hypnotized by the rolling log. Suddenly he pulled a lever. The log stopped turning and began to move out of the way of another monster entering the machine. Burt took Mac's arm, leading him away from the noise to another platform. Here the debarker was idle.

"Why two of these?" asked Mac, curious.

"That machine takes logs above 24 in., while this one handles the smaller logs."

"What does this thing do?" Mac looked for some operating mechanism besides the few levers visible. "I've never gotten close to one of these things before."

"The operating parts are all below the floor," explained Burt. "There are four sliding valves that control the steam cylinders. These work the hooks or palls that grip and turn the logs. Let's go below."

Under the platform, Mac found a maze of rods, timbers, and pipes that astonished him. Burt led him to an upright piston type valve, evidently operated by a series of rods from the shift lever above. He studied the valve a few moments. "What's this cross arm and weight for?" he asked.

"That weight is supposed to counterbalance the parts of the operating mechanism," declared Burt. "Sometimes the operators work the valves so fast that the weights get to swinging. Then a cylinder or two gets out of step and trouble begins.

"Why not put a light spring on those weights to hold them steady?" asked Mac. "The springs could be attached to the pipe below the valves and could be light enough so that they would be like a gentle hand holding the weights from swinging."

"That, Mr. MacVane, is a darn good idea," laughed Burt, putting his hand on Mac's shoulder. "Now tell me how to keep these piston stuffing boxes tight."

Mac looked at the screwdown stuffing boxes. They were pulled down almost to their limit. He shook his head. "While this outfit is down, why don't you get someone to repack those boxes? Then inspect them regularly." He examined the stem of the valve critically. "This stem is scored now," he declared. "Burt, if you don't take care of equipment you can't expect it to work." He looked away. "It's the same old story. You fellows all expect packing to last forever." He made a face at his friend.

Disassemble Gate Valve

"Let's go back to that gate valve," suggested Mac.

When they arrived at the pump, Bob had the motor operator, bonnet, and stem hanging on the chain fall. The disc was lying on a paper on the floor. Mac looked the disc over carefully. "Which is the down side of this disc?" he asked.

"That's it there, on top," answered Bob. "The valve has only been operated a few times since we put in the new rings. It never has been fully closed with the motor."

"Are you sure that it can be closed?" asked Mac.

"It'll close all right," declared Bob. "When we got it assembled, we ran down the stem by hand without pressure on the valve. It went all the way home." He looked at Burt for confirmation.

"Yes, Mac," asserted the superintendent, "that valve will close tight. But not with pressure on it. That's what causes the trouble."

"Vibration," said Mac softly.

"What the —?" began Burt.

". . . water can flow into the cavitation and break it up."

"You're nuts!" barked Bob.

"Vibration," repeated Mac firmly, looking from one to the other. "Our old friend, vibration." He grinned mockingly. Putting his hand down into the valve body, he felt carefully around the new seat ring. "Yep," he declared, "that's it."

"Both men eyed the gasket salesman doubtfully. Finally, Burt said, "All right. It's vibration. Suppose you explain."

"Have you got a piece of paper, Bob?" asked Mac, as he took a pencil from his pocket. He took the paper to the bench and drew a sketch. "You have 2500 psi water on one side of that disc. On the other side, you have only the resistance of the piping and the restrictions of the nozzles. For the sake of argument, say that the total is 200 psi. That leaves a force of 2300 psi going through the valve." He looked at Burt thoughtfully. "Any idea of what the velocity of that water is, Burt?" he asked.

Burt shrugged his shoulders without answering. Bob said, "Pretty high."

Velocity Creates Cavitation

"Suppose you close that valve by hand. The task becomes harder and harder as you decrease the opening. Finally, it takes all that two men on the end of fairly long levers can do to bring it to its seat." Both nodded. "Now," as you near the closing position, the opening takes the shape of a crescent moon, getting narrower as you come to the point where the disc and seat ring overlap." He made a sketch of the opening.

"I still can't see what that has to do with vibration," declared Burt.

"As the opening gets smaller, the velocity steadily increases. When you get to a certain point, the velocity begins to create a cavitation behind the lower edge of the disc."

"Oh!" breathed Bob.

"Yes, Bob," smiled Mac. "A cavitation is always a make and break affair. Here the rate is so high that you don't hear it. The sound is deadened, too, by the water and the sound of the pump." Mac drew the picture of the water spouting under the disc. "The disc is pulled up against the seat ring with the rapid making and breaking of the cavity."

"How come we can close the valve by hand but the motor won't do it?" asked Burt.

"It's the difference in the way the power is applied," declared Mac. "When you do the job by hand, you can counteract the cavitation to some extent. But you had to ruin the seat ring doing it. It wore a groove into the ring that would eventually have stopped your operation. When you applied the motor, the cavitation drew the disc into the groove, setting up such a heavy resistance that the torque switch acted to stop the motor."

"But the new rings haven't any grooves," asserted Bob.

"True, Bob, but you still have the cavitation. Also, the friction load created by it, on top of the pressure load, is more than the motor can carry."

"Then the motor operators are no good," lamented Burt.

"The motor operators are all right," declared Mac.

"They won't close the valves!" said Bob sharply.

"Can be done," asserted Mac cheerfully.

"How?" asked Bob and Burt in chorus.

Drill Hole To Break Cavity

"This way." Mac drew a drilled hole from the bottom of the disc to the upper edge of the disc ring with deliberate care. "Just drill a 1/8 in. hole from the bottom of this disc to a point as close to the seating surface on the low side as you can get. Water can then flow into the cavitation from the bottom of the disc, breaking it up as you come near the closing point."

"Will it work?" asked Burt.

"Gosh, it should, at that," declared Bob hopefully. "But what about leakage when the valve is closed?"

"In these days of steel valves, you'll find, unless a valve is badly worn or has been distorted, that both sides of the disc will be tight. In fact, most factories work to such close tolerances that you can turn the disc around, and the valve will still be tight."

"We're going to try that stunt right now," said Bob enthusiastically. He turned to a fitter, directing him to bring the disc.

"That will take a while," said Burt. "They'll have to set up the valve again, too. Let's go up to the office where we can talk."

Later, Bob barged into the room. "By gosh, it works!" he shouted. "Had to set back that limit switch a lot, too. Closes smooth as silk." He extended his hand to Mac. "Gee, Mr. MacVane, I'm glad you came along. Thanks for the help."

"Just keep this in mind, Bob," suggested Mac. "Fast water does fantastic things. Even the engineers of Crete discovered in 2500 B.C. that water flowing over a sharp edge will always follow a parabolic curve; and when attaining considerable velocity it will create a cavitation underneath." He smiled soberly at the engineer. "Fast water can tear a pipe or a valve with water hammer, too, if you try to stop it too suddenly. So, watch out. Fast water may be dangerous."

"That goes for fishing water, too," laughed Burt.

"Let's look up that dinner," suggested Mac. He shook hands again with Bob. "Glad to have met you. Good luck with your motor operators from now on."

"Good luck with your fast water fishing, too," said Bob as he left.

SAM LEWIS' PAGE

The School Bell Rang at Night

. . . until the operation of a boilerfeed make-up water valve was corrected

I WAS CALLED IN once to help solve an unusual boilerfeed problem. There are three very large stoker-fired 150 lb water tube steam heating boilers. They heat a campus crowded with high school buildings that serve a heavily populated township.

The boiler house is a separate building connected to the various heating systems, with many pipes in a walk-through tunnel. This tunnel encompasses a high pressure steam pipe line, low pressure steam line, compressed air line, subatmospheric vacuum return line, and 30 psi condensate return line. An improper and objectionable feature of this tunnel burden is that the cold water main service line for all of the buildings also is within it.

Hereby, I recommend that a cold pipe line hundreds of feet long shall not be placed in the same tunnel as a maze of hot piping. I'd bury the cold pipe in the ground away from the tunnel. No matter how well the pipes are insulated, heat transfer will occur.

Often the wet spots due to condensed vapor cause the insulation on the cold piping to become less effective. Who, seeking a drink of reviving cool water, likes instead to find his cup overflowing with tepid water?

The three boilers each were equipped with a well known automatic water line governor, that causes the make-up water valve to open if the water level in the boiler becomes too low, and to close if the water level is too high. The governor has an inclined thermostatic tube. Failure of enough water in the lower part of the tube to counteract the heat from the steam in the higher part of the tube will cause the make-up water valve to open, provided that the boilerfeed pump maintains pressure in the feed pipe higher than that in the boiler. As soon as the entering water rises in response to the opened feed valve, and thus reduces the steam heat in the higher end of the tube, the make-up water valve closes.

However, this high school plant operates all summer; and the operating crew desires to stay home on summer nights, even though there may be a night fireman during the winter.

The feedwater heater and condensate receiver are placed higher than the inlet of the centrifugal boilerfeed pump, so that the hot water will fall freely down into the inlet of the pump. They also happen to be well above the boiler water level. There is a check valve between the boilerfeed pump discharge header and each boiler, but centrifugal pumps have no objection to one-way flowage of water through the impellers so long as the check valve is favorable.

So, the operating crew filled the furnace under the boiler with coal, shut down the stoker and the boilerfeed pump and went home. The banked fire in the furnace, plus the residual heat in the refractory, eventually boiled away enough water so that the make-up water valve was opened by the water line governor.

However, the boilerfeed pump was shut down, and soon the electric low water alarm commenced to tell the neighbors of negligence by the engineers. As a result, they added an electric float switch, No. 2, independent of the No. 1 thermostatic water level device. No. 2 was to stop-start the boilerfeed pump if the water level became too low. However, the water flowing down from the overhead receiver, encouraged by the pump operation, frequently kept coming along and occasionally overfilled the boiler, despite the thermostatic control No. 1. This device, feeling no steam heat, could not close the make-up water valve. Again the high water alarm alarmed the neighbors!

I hope that the alarms now will be quiet, since I added an electric valve that closes whenever the float controller No. 2 starts the boilerfeed pump and closes when the pump stops. I also fixed it so that this valve opens regardless of the float whenever the pump runs. In addition, the water discharged by the pump must now climb over a hilltop before coming down to enter the boiler, thus to discourage the occasional subatmospheric pressure, due to condensation within the boiler, from pulling is idle.≠

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

Solar Irradiation of Southeast or Southwest Inclines

By F. W. Hutchinson* and M. O. Cotter**

THIS IS THE LAST of the current series of three data sheets covering the hourly and monthly irradiation of inclined surfaces. Thus, the entire series of nine data sheets giving irradiation rates of vertical or inclined surfaces in any direction in latitudes from 30 to 45 deg is now complete.***

The others have discussed the significance of solar data and have explained the methods of using it. The derivations are presented here for the evaluation of the equivalent solar altitude, the equivalent azimuth, and the actual angle of incidence — the angle between the sun's rays and a normal to the irradiated surface — for an inclined surface.

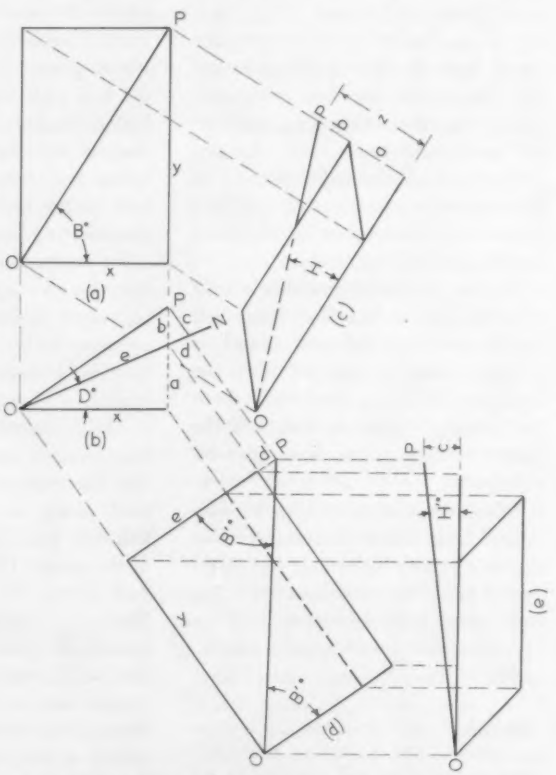
Basic Principles. Solar azimuth, A, represents a horizontal angle measured in degrees clockwise from north. Thus, for 180 deg of azimuth the sun would be in a position such that its projection on a horizontal plane would be due south. For a vertical wall facing southeast, direct solar irradiation would not occur until the azimuth of the morning sun equalled or exceeded 45 deg. For 45 deg azimuth the sun's rays would just be parallel to the face of the wall or would make a 90 deg horizontal angle, B, with the normal to the wall. Thus for any azimuth from 45 to 225 deg the horizontal angle made with a normal to the wall would be the difference, regardless of algebraic sign, between the azimuth and 135 deg. For a wall facing southeast, but inclined backward from the vertical, irradiation would start before the azimuth reached 45 deg — hence for a B angle greater than 90 deg — and would continue for a period after the azimuth exceeded 225 deg — hence, again, for B angles greater than 90 deg.

Solar altitude, H, is measured in a vertical plane and is expressed as degrees above the horizon.

The equivalent values of azimuth and of altitude, A' and B', are geometrically related to an inclined wall in the same way that the actual values are related to a vertical wall. Thus, for a wall inclined D deg backward from normal, the equivalent values of azimuth and of horizontal angle, A' and B', respectively, are measured in a plane running through the base of the wall and inclined upward from the horizontal by an amount equal to the backward inclination of the actual wall. The equivalent solar altitude, H', is likewise measured in degrees above the plane in which A' and B' are measured. Once the equivalent angles B' and H' have been determined, the angle of incidence is then directly obtained from the equation

$$\cos i = (\cos H') (\cos B')$$

Evaluation of Equivalent Angles. The geometrical relationships involved in establishing the trigonometric expressions for the equivalent angles B' and H' are shown in Fig. 1. Fig. 1a is a plan view of the system for a wall facing southeast, but inclined D deg backward from the vertical. Considering a point, O, on such a wall, the line OP is the horizontal projection of the line from O to the position of the sun, and B is the actual horizontal angle. Distances x and y are lengths of sides of an arbitrarily selected rectangle based on OP as the hypotenuse. Fig. 1b is an elevation of the system in a vertical plane which runs in a southeastern direction. The line, ON, is a normal to the wall, hence is at an angle D with the horizontal. Note that the same angle, D, also appears between b and c of the smaller triangle in Fig. 1b. Fig. 1c is an elevation of the system of Fig. 1a taken in a



1 GEOMETRICAL RELATIONSHIPS involved in establishing the trigonometric expressions for the equivalent angles B' and H' are shown here

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***Irradiation of vertical walls was covered in two previous series of Data Sheets: irradiation tables for October through April appeared in the July 1949, December 1950, and May 1951 issues of HPAC; tables for May through September appeared in the September, October, and November 1954 HPAC's. Data sheets for inclined surfaces facing south, east or west were in August and September 1955 HPAC's.

direction normal to line *OP*. Fig. 1d is a plan in a plane through *OP*; Fig. 1e is an elevation taken from 1d.

a) Finding the Equivalent Solar Altitude, H'. Referring to Fig. 1 and using the nomenclature indicated thereon: In Fig. 1a let distance x equal unity. Then, from Fig. 1a

$$y = \tan B$$

and from Fig. 1b

$$a = \tan D$$

From Figs. 1a and 1c

$$z = (x^2 + y^2)^{\frac{1}{2}} (\tan H) - (1 + \tan^2 B)^{\frac{1}{2}} (\tan H)$$

and

$$b = z - a = (\tan H)\ (x^2 + y^2)^{\frac{1}{2}} - \tan D$$
$$= (\tan H)\ (1 + \tan^2 B)^{\frac{1}{2}} - \tan D$$

From Fig. 1b

$$c = b\ (\cos D) = [(\tan H)\ (1 + \tan^2 B)^{\frac{1}{2}} - \tan D]\ (\cos D)$$

But the distance OP is the sum of the squares of the distances x, y, and z, or

$$OP = [1 + \tan^2 B + (1 + \tan^2 B)\ (\tan^2 H)]^{\frac{1}{2}}$$
$$= [(1 + \tan^2 B)\ (1 + \tan^2 H)]^{\frac{1}{2}}$$

From Fig. 1b the sine of H' is c/OP, hence

$$\text{sine } H' = \{[(\tan H)\ (1 + \tan^2 B)^{\frac{1}{2}} - (\tan D)]\ (\cos D)\} / [(1 + \tan^2 B)\ (1 + \tan^2 H)]^{\frac{1}{2}}$$

Knowing sine H', the degree value of the equivalent

Table 9b Southeast or Southwest Wall — Latitude 30°

Solar Time S. E.	Solar Time S. W.	I_o	30° Slope backward i	30° Slope backward cos i	30° Slope backward $I_o \cos i$	60° Slope backward i	60° Slope backward cos i	60° Slope backward $I_o \cos i$	Horizontal i	Horizontal cos i	Horizontal $I_o \cos i$
December											
8 a.m.,	4 p.m.	191.2	21	0.933	178.2	50	0.648	123.8	79	0.191	36.5
9 a.m.,	3 p.m.	264.1	9	0.988	261.0	39	0.776	205.0	69	0.358	94.7
10 a.m.,	2 p.m.	284.8	11	0.980	279.0	32	0.846	241.0	61	0.485	138.0
11 a.m.,	1 p.m.	295.6	24	0.913	270.0	31	0.860	254.2	55	0.574	169.6
12 noon		297.6	38	0.790	235.0	36	0.804	239.1	53	0.602	179.1
1 p.m.,	11 a.m.	295.6	52	0.621	183.5	46	0.691	204.1	55	0.574	169.6
2 p.m.,	10 a.m.	284.8	66	0.413	117.6	65	0.418	119.1	61	0.485	138.0
3 p.m.,	9 a.m.	264.1	79	0.194	51.2	72	0.317	83.7	69	0.358	94.7
4 p.m.,	8 a.m.	191.2	76	0.242	46.2	76	0.248	47.3	79	0.191	36.5
Jan. or Nov.											
8 a.m.,	4 p.m.	216.0	20	0.938	202.7	48	0.669	144.6	77	0.225	48.6
9 a.m.,	3 p.m.	278.0	6	0.994	276.5	36	0.808	224.7	66	0.407	113.0
10 a.m.,	2 p.m.	294.0	11	0.983	289.0	29	0.874	257.0	58	0.530	155.7
11 a.m.,	1 p.m.	304.0	24	0.915	278.4	28	0.885	269.0	52	0.616	187.2
12 noon		306.0	38	0.790	242.0	34	0.827	253.0	50	0.643	196.7
1 p.m.,	11 a.m.	304.0	51	0.625	190.0	44	0.716	217.9	52	0.616	187.2
2 p.m.,	10 a.m.	294.0	65	0.417	122.7	63	0.458	134.7	58	0.530	155.7
3 p.m.,	9 a.m.	278.0	77	0.251	64.3	68	0.368	102.4	66	0.407	113.0
4 p.m.,	8 a.m.	216.0	73	0.288	62.2	73	0.296	87.6	77	0.225	48.6
Feb. or Oct.											
7 a.m.,	5 p.m.	232.0	34	0.826	192.0	58	0.531	123.1	82	0.139	21.1
8 a.m.,	4 p.m.	251.1	15	0.964	242.0	42	0.739	185.5	72	0.309	77.6
9 a.m.,	3 p.m.	285.7	7	0.992	283.3	32	0.852	243.5	61	0.485	138.5
10 a.m.,	2 p.m.	301.5	10	0.984	296.9	22	0.930	280.4	51	0.629	189.6
11 a.m.,	1 p.m.	309.4	24	0.914	282.8	19	0.943	291.7	44	0.719	222.6
12 noon		312.4	39	0.779	243.3	27	0.887	277.0	41	0.755	236.0
1 p.m.,	11 a.m.	309.4	53	0.595	184.0	41	0.759	234.9	44	0.719	222.6
2 p.m.,	10 a.m.	301.5	67	0.385	116.1	54	0.585	176.5	51	0.629	189.6
3 p.m.,	9 a.m.	285.7	70	0.348	99.5	61	0.482	137.5	61	0.485	138.5
4 p.m.,	8 a.m.	251.1	66	0.409	102.7	65	0.415	104.2	72	0.309	77.6
5 p.m.,	7 a.m.	232.0	62	0.473	109.7	69	0.353	81.8	82	0.139	21.1
Mar. or Sept.											
6 a.m.,	6 p.m.	56.0	50	0.643	36.0	65	0.422	23.6	85	0.087	4.9
7 a.m.,	5 p.m.	157.0	39	0.776	121.9	54	0.591	92.9	76	0.242	38.0
8 a.m.,	4 p.m.	225.0	27	0.894	199.2	40	0.768	171.3	64	0.438	97.8
9 a.m.,	3 p.m.	258.9	17	0.954	247.0	24	0.912	236.1	51	0.629	163.0
10 a.m.,	2 p.m.	274.6	19	0.943	258.8	13	0.976	268.0	41	0.755	207.3
11 a.m.,	1 p.m.	283.3	35	0.816	231.0	8	0.991	280.9	32	0.848	240.2
12 noon		285.5	43	0.734	209.5	22	0.928	265.0	29	0.875	249.8
1 p.m.,	11 a.m.	283.3	57	0.551	156.2	37	0.805	227.5	32	0.848	240.2
2 p.m.,	10 a.m.	274.6	65	0.427	117.2	47	0.682	180.5	41	0.755	207.3
3 p.m.,	9 a.m.	258.9	58	0.534	138.2	48	0.672	173.8	51	0.629	163.0
4 p.m.,	8 a.m.	225.0	53	0.608	135.6	53	0.605	134.8	64	0.438	97.8
5 p.m.,	7 a.m.	157.0	50	0.639	100.2	59	0.508	79.7	76	0.242	38.0
6 p.m.,	6 a.m.	56.0	48	0.665	37.2	64	0.434	24.3	85	0.087	4.9
Apr. or Aug.											
6 a.m.,	6 p.m.	69.0	57	0.542	37.4	67	0.383	26.4	83	0.122	8.4
7 a.m.,	5 p.m.	202.8	44	0.721	146.2	51	0.623	126.5	69	0.358	72.7
8 a.m.,	4 p.m.	241.0	35	0.820	197.7	39	0.780	187.9	58	0.530	127.7
9 a.m.,	3 p.m.	270.4	29	0.871	235.8	25	0.918	248.2	44	0.719	194.5
10 a.m.,	2 p.m.	282.5	30	0.866	244.6	10	0.984	278.0	33	0.839	237.0
11 a.m.,	1 p.m.	289.4	38	0.788	228.0	8	0.991	287.0	22	0.927	268.4
12 noon		290.7	48	0.665	193.2	19	0.944	274.2	18	0.951	276.5
1 p.m.,	11 a.m.	289.4	61	0.487	140.7	35	0.817	236.5	22	0.927	268.4
2 p.m.,	10 a.m.	282.5	55	0.574	162.0	35	0.815	230.5	33	0.839	237.0
3 p.m.,	9 a.m.	270.4	47	0.679	183.6	47	0.679	183.5	44	0.719	194.5
4 p.m.,	8 a.m.	241.0	42	0.747	180.0	46	0.700	168.5	58	0.530	127.7
5 p.m.,	7 a.m.	202.8	39	0.780	158.1	49	0.657	133.3	69	0.358	72.7
6 p.m.,	6 a.m.	69.0	39	0.775	65.4	59	0.517	35.7	83	0.122	8.4
May or July											
6 a.m.,	6 p.m.	107.5	61	0.487	52.4	68	0.382	41.0	80	0.174	18.7
7 a.m.,	5 p.m.	207.2	51	0.636	131.6	54	0.584	121.0	68	0.375	77.6
8 a.m.,	4 p.m.	252.2	41	0.754	190.2	39	0.773	195.1	54	0.588	148.3
9 a.m.,	3 p.m.	273.4	37	0.802	219.2	27	0.893	244.2	42	0.743	203.0
10 a.m.,	2 p.m.	285.5	37	0.794	226.7	16	0.963	274.8	29	0.875	250.0
11 a.m.,	1 p.m.	291.3	43	0.727	211.8	15	0.965	281.0	17	0.956	278.6
12 noon		293.1	53	0.598	175.5	23	0.921	270.1	10	0.985	288.7
1 p.m.,	11 a.m.	291.3	58	0.531	154.5	31	0.859	250.4	17	0.956	278.6
2 p.m.,	10 a.m.	285.5	49	0.661	188.5	28	0.885	252.9	29	0.875	250.0
3 p.m.,	9 a.m.	273.4	41	0.759	207.8	30	0.868	237.2	42	0.743	203.0
4 p.m.,	8 a.m.	252.2	35	0.823	207.5	36	0.814	205.5	54	0.588	148.3
5 p.m.,	7 a.m.	207.2	51	0.854	177.0	45	0.709	147.0	68	0.375	77.6
6 p.m.,	6 a.m.	107.5	33	0.840	90.4	54	0.586	63.0	80	0.174	18.7
June											
6 a.m.,	6 p.m.	149.9	62	0.469	70.3	66	0.401	60.1	77	0.225	33.8
7 a.m.,	5 p.m.	237.9	48	0.673	160.0	47	0.685	163.0	59	0.515	122.5
8 a.m.,	4 p.m.	254.6	44	0.717	182.6	41	0.752	193.9	53	0.602	153.3
9 a.m.,	3 p.m.	276.9	40	0.768	212.6	27	0.893	247.1	39	0.777	215.1
10 a.m.,	2 p.m.	286.7	39	0.774	221.7	13	0.974	279.4	27	0.891	255.5
11 a.m.,	1 p.m.	292.2	47	0.681	199.0	18	0.952	278.0	14	0.970	283.2
12 noon		293.7	56	0.562	165.2	26	0.898	263.8	6	0.995	292.0
1 p.m.,	11 a.m.	292.2	56	0.560	163.7	28	0.884	258.3	14	0.970	283.2
2 p.m.,	10 a.m.	286.7	45	0.705	202.0	19	0.944	267.8	27	0.891	255.5
3 p.m.,	9 a.m.	276.9	39	0.781	216.0	26	0.899	248.9	39	0.777	215.1
4 p.m.,	8 a.m.	254.6	31	0.854	217.4	33	0.840	214.0	53	0.602	153.3
5 p.m.,	7 a.m.	237.9	29	0.873	207.7	37	0.802	190.7	59	0.515	122.5
6 p.m.,	6 a.m.	149.9	29	0.876	131.3	51	0.624	93.6	77	0.225	33.8

Table 10b Southeast or Southwest Wall — Latitude 35°

Solar Time S. E.	Solar Time S. W.	I_o	30° Slope backward i	30° Slope backward cos i	30° Slope backward $I_o \cos i$	60° Slope backward i	60° Slope backward cos i	60° Slope backward $I_o \cos i$	Horizontal i	Horizontal cos i	Horizontal $I_o \cos i$
December											
8 a.m.,	4 p.m.	182.9	22	0.929	170.0	50	0.637	116.5	80	0.174	31.8
9 a.m.,	3 p.m.	245.1	13	0.973	238.7	43	0.731	179.2	73	0.292	71.7
10 a.m.,	2 p.m.	274.8	14	0.972	267.0	37	0.795	218.5	66	0.407	111.8
11 a.m.,	1 p.m.	285.7	25	0.905	258.5	37	0.802	229.7	61	0.485	138.5
12 noon		288.6	38	0.783	226.0	41	0.749	216.0	59	0.515	148.6
1 p.m.,	11 a.m.	285.7	52	0.610	174.2	51	0.632	180.4	61	0.485	138.5
2 p.m.,	10 a.m.	274.8	66	0.400	110.0	62	0.472	129.7	66	0.407	111.8
3 p.m.,	9 a.m.	245.1	78	0.202	49.6	74	0.271	66.4	73	0.292	71.7
4 p.m.,	8 a.m.	182.9	77	0.220	40.3	75	0.252	46.0	80	0.174	31.8
Jan. or Nov.											
8 a.m.,	4 p.m.	195.0	22	0.930	181.4	50	0.647	126.1	79	0.191	37.2
9 a.m.,	3 p.m.	268.0	9	0.989	265.2	39	0.777	208.2	69	0.358	96.1
10 a.m.,	2 p.m.	287.0	11	0.980	281.3	33	0.837	240.1	62	0.470	134.8
11 a.m.,	1 p.m.	294.0	24	0.914	268.7	33	0.834	245.0	58	0.530	155.8
12 noon		300.0	38	0.789	236.5	38	0.786	236.0	55	0.574	172.2
1 p.m.,	11 a.m.	294.0	55	0.576	169.3	49	0.658	193.5	58	0.530	155.8
2 p.m.,	10 a.m.	287.0	66	0.407	116.8	60	0.506	145.3	62	0.470	134.8
3 p.m.,	9 a.m.	268.0	71	0.320	85.8	68	0.370	99.2	69	0.358	96.1
4 p.m.,	8 a.m.	195.0	75	0.257	50.0	75	0.258	50.3	79	0.191	37.2
Feb. or Oct.											
7 a.m.,	5 p.m.	150.2	22	0.927	139.3	51	0.624	93.8	82	0.139	20.9
8 a.m.,	4 p.m.	245.1	20	0.937	229.9	45	0.711	174.2	73	0.292	71.7
9 a.m.,	3 p.m.	281.7	7	0.992	279.5	33	0.836	235.4	63	0.454	127.8
10 a.m.,	2 p.m.	297.5	9	0.988	293.8	25	0.910	270.5	54	0.588	175.0
11 a.m.,	1 p.m.	304.4	23	0.920	280.0	24	0.911	277.3	49	0.656	200.0
12 noon		307.4	38	0.788	242.0	31	0.856	263.0	46	0.695	213.8
1 p.m.,	11 a.m.	304.4	53	0.604	183.8	43	0.728	221.5	49	0.656	200.0
2 p.m.,	10 a.m.	297.5	67	0.390	116.0	56	0.565	168.2	54	0.588	175.0
3 p.m.,	9 a.m.	281.7	71	0.321	90.3	63	0.448	126.0	63	0.454	127.8
4 p.m.,	8 a.m.	245.1	67	0.389	95.3	67	0.394	96.6	73	0.292	71.7
Mar. or Sept.											
6 a.m.,	6 p.m.	56.0	50	0.643	36.0	65	0.422	23.6	85	0.087	4.9
7 a.m.,	5 p.m.	157.0	38	0.792	124.4	53	0.597	93.8	76	0.242	38.0
8 a.m.,	4 p.m.	223.0	25	0.907	202.3	39	0.777	173.2	64	0.438	97.8
9 a.m.,	3 p.m.	258.9	16	0.962	249.0	23	0.919	237.9	51	0.629	162.8
10 a.m.,	2 p.m.	273.4	18	0.951	260.0	12	0.978	267.5	42	0.743	203.1
11 a.m.,	1 p.m.	280.8	29	0.878	246.5	11	0.980	275.2	35	0.819	230.0
12 noon		283.3	42	0.749	212.1	23	0.922	261.3	32	0.848	240.3
1 p.m.,	11 a.m.	280.8	55	0.571	160.4	36	0.804	225.5	35	0.819	230.0
2 p.m.,	10 a.m.	273.4	68	0.382	104.4	50	0.649	177.5	42	0.743	203.1
3 p.m.,	9 a.m.	258.9	60	0.501	129.6	49	0.652	168.9	51	0.629	162.8
4 p.m.,	8 a.m.	223.0	53	0.606	135.2	68	0.380	84.7	64	0.438	97.8
Apr. or Aug.											
6 a.m.,	6 p.m.	83.5	56	0.561	46.9	66	0.405	33.8	82	0.139	11.6
7 a.m.,	5 p.m.	189.8	44	0.722	137.0	53	0.605	114.9	71	0.326	61.8
8 a.m.,	4 p.m.	241.0	13	0.974	234.8	37	0.798	192.5	58	0.530	127.7
9 a.m.,	3 p.m.	267.7	26	0.902	241.3	23	0.922	246.7	46	0.695	186.0
10 a.m.,	2 p.m.	281.6	27	0.889	250.3	7	0.992	279.4	34	0.829	233.5
11 a.m.,	1 p.m.	287.2	34	0.825	236.8	5	0.996	286.0	26	0.899	258.1
12 noon		289.3	46	0.693	200.5	20	0.937	271.2	22	0.927	268.3
1 p.m.,	11 a.m.	287.2	59	0.514	147.7	35	0.823	236.2	26	0.899	258.1
2 p.m.,	10 a.m.	281.6	59	0.515	145.0	39	0.777	218.4	34	0.829	233.5
3 p.m.,	9 a.m.	267.7	50	0.638	170.6	40	0.764	204.4	46	0.695	186.1
4 p.m.,	8 a.m.	241.0	44	0.717	173.0	44	0.720	173.6	58	0.530	127.7
5 p.m.,	7 a.m.	189.8	40	0.761	144.3	51	0.627	118.5	71	0.326	61.8
6 p.m.,	6 a.m.	83.5	40	0.767	64.1	58	0.526	44.0	82	0.139	11.6
May or July											
6 a.m.,	6 p.m.	133.5	60	0.501	67.0	66	0.410	54.8	78	0.208	27.8
7 a.m.,	5 p.m.	211.6	48	0.664	140.5	52	0.610	129.1	67	0.391	82.6
8 a.m.,	4 p.m.	252.2	39	0.781	197.0	38	0.791	199.5	54	0.588	148.3
9 a.m.,	3 p.m.	274.6	33	0.836	230.3	23	0.918	252.0	41	0.755	207.3
10 a.m.,	2 p.m.	284.8	34	0.832	237.0	11	0.980	279.0	30	0.866	246.7
11 a.m.,	1 p.m.	290.2	40	0.767	222.6	10	0.986	286.3	20	0.940	272.9
12 noon		291.9	46	0.696	203.1	10	0.985	287.6	15	0.966	282.0
1 p.m.,	11 a.m.	290.2	52	0.620	180.0	26	0.900	261.1	20	0.940	272.9
2 p.m.,	10 a.m.	284.8	53	0.603	171.8	32	0.847	241.1	30	0.866	246.7
3 p.m.,	9 a.m.	274.6	44	0.714	196.0	32	0.847	232.5	41	0.755	207.3
4 p.m.,	8 a.m.	252.2	37	0.798	201.3	37	0.801	202.0	54	0.588	148.3
5 p.m.,	7 a.m.	211.6	33	0.839	177.6	45	0.711	145.4	67	0.391	82.6
6 p.m.,	6 a.m.	133.5	32	0.852	113.8	52	0.612	81.7	78	0.208	27.8
June											
6 a.m.,	6 p.m.	157.0	61	0.490	76.9	65	0.423	66.4	76	0.242	38.0
7 a.m.,	5 p.m.	223.0	50	0.643	143.4	51	0.625	139.4	64	0.438	97.8
8 a.m.,	4 p.m.	256.7	41	0.756	194.0	41	0.756	194.1	52	0.616	158.1
9 a.m.,	3 p.m.	276.9	36	0.807	223.5	24	0.916	253.6	39	0.777	215.0
10 a.m.,	2 p.m.	286.7	36	0.813	233.0	5	0.996	285.7	27	0.891	255.3
11 a.m.,	1 p.m.	291.3	43	0.730	212.8	13	0.974	284.0	17	0.956	278.8
12 noon		292.7	52	0.616	180.3	23	0.920	269.4	12	0.978	283.2
1 p.m.,	11 a.m.	291.3	60	0.506	147.3	33	0.843	245.9	17	0.956	278.8
2 p.m.,	10 a.m.	286.7	50	0.646	185.4	26	0.900	258.0	27	0.891	255.3
3 p.m.,	9 a.m.	276.9	42	0.739	204.5	29	0.876	242.5	39	0.777	215.0
4 p.m.,	8 a.m.	256.7	35	0.822	211.1	34	0.831	213.2	52	0.616	158.1
5 p.m.,	7 a.m.	223.0	30	0.870	194.0	41	0.757	168.8	64	0.438	97.8
6 p.m.,	6 a.m.	157.0	29	0.875	137.4	50	0.646	101.5	76	0.242	38.0

solar altitude can be readily determined from any table of trigonometric functions.

b) Finding the Equivalent Horizontal Angle, B'. From Figs. 1a, 1b and 1d

$$\tan B' = y/(d + e) = (\tan B)/[b \cos (90 - D) + 1/\cos D]$$
$$= (\tan B)/\{[\tan H\ (1 + \tan^2 B)^{\frac{1}{2}} - \tan D] \cos (90 - D) + 1/\cos D\}$$

Knowing tan B', the degree value of the equivalent horizontal angle can be readily determined from any table of trigonometric functions.

c) Finding the Actual Angle of Incidence, i. Knowing B' and H', the angle of incidence, i, is determined as that angle which has a cosine equal to the products of the cosines of B' and H'.

Where the user is concerned only with the angle of incidence and with the rate of irradiation resultant from this angle, the above derivation of equivalent solar angles can be bypassed and the cosine of the actual angle of incidence can be calculated from the equation:

$$\cos i = [1 + (1 + \tan^2 B)^{\frac{1}{2}} (\tan H) (\tan D)] / [(1 + \tan^2 B)\ (1 + \tan^2 H)\ (1 + \tan^2 D)]^{\frac{1}{2}}$$

This latter equation is the one which has been used to calculate the cosine i values for inclined walls.

Table 11b Southeast or Southwest Wall — Latitude 40°

Solar Time		I_o	30° Slope backward			60° Slope backward			Horizontal		
S. E.	S. W.		i	cos i	$I_o$cos i	i	cos i	$I_o$cos i	i	cos i	$I_o$cos i
December											
8 a.m.,	4 p.m.	168.0	23	0.923	155.0	51	0.623	104.7	81	0.156	26.3
9 a.m.,	3 p.m.	224.7	16	0.959	215.5	46	0.694	155.9	76	0.242	54.3
10 a.m.,	2 p.m.	260.2	18	0.953	248.0	41	0.749	194.7	70	0.342	89.0
11 a.m.,	1 p.m.	274.8	27	0.889	244.3	41	0.750	206.0	66	0.407	111.8
12 noon		275.9	40	0.767	211.5	47	0.687	190.1	65	0.423	113.8
1 p.m.,	11 a.m.	274.8	53	0.596	163.7	54	0.581	159.5	66	0.407	111.8
2 p.m.,	10 a.m.	260.2	67	0.396	103.0	65	0.426	111.0	70	0.342	89.0
3 p.m.,	9 a.m.	224.7	81	0.165	37.0	79	0.187	42.0	76	0.242	54.3
4 p.m.,	8 a.m.	168.0	78	0.210	35.3	78	0.213	35.7	81	0.156	26.3
Jan. or Nov.											
8 a.m.,	4 p.m.	170.0	24	0.917	155.9	52	0.620	105.4	81	0.156	26.6
9 a.m.,	3 p.m.	241.0	14	0.971	234.0	44	0.720	173.5	74	0.276	66.4
10 a.m.,	2 p.m.	278.0	14	0.972	280.0	37	0.796	223.0	66	0.407	113.0
11 a.m.,	1 p.m.	287.0	24	0.910	261.0	37	0.796	228.5	62	0.470	134.7
12 noon		289.0	38	0.788	227.8	42	0.746	215.8	61	0.485	140.0
1 p.m.,	11 a.m.	287.0	53	0.595	170.6	52	0.614	176.4	62	0.470	134.7
2 p.m.,	10 a.m.	278.0	66	0.400	111.3	62	0.472	131.2	66	0.407	113.0
3 p.m.,	9 a.m.	241.0	81	0.152	36.7	81	0.152	36.7	74	0.276	66.4
4 p.m.,	8 a.m.	170.0	76	0.242	41.1	77	0.230	39.1	81	0.156	26.6
Feb. or Oct.											
7 a.m.,	5 p.m.	150.2	34	0.833	125.2	56	0.562	84.3	82	0.139	20.9
8 a.m.,	4 p.m.	232.3	22	0.930	216.0	47	0.684	159.0	75	0.259	60.1
9 a.m.,	3 p.m.	273.8	7	0.992	271.6	36	0.806	220.5	66	0.407	111.3
10 a.m.,	2 p.m.	291.6	9	0.987	288.1	31	0.856	255.8	58	0.530	154.5
11 a.m.,	1 p.m.	298.5	23	0.918	274.0	29	0.877	262.0	53	0.602	179.6
12 noon		301.5	38	0.793	239.0	35	0.820	247.1	51	0.629	189.6
1 p.m.,	11 a.m.	298.5	51	0.623	185.9	45	0.707	211.1	53	0.602	179.6
2 p.m.,	10 a.m.	291.6	65	0.420	122.3	58	0.529	154.5	58	0.530	154.5
3 p.m.,	9 a.m.	273.8	75	0.260	71.1	67	0.385	105.4	66	0.407	111.3
4 p.m.,	8 a.m.	232.3	68	0.374	86.8	69	0.365	84.8	75	0.259	60.1
5 p.m.,	7 a.m.	150.2	62	0.468	70.3	69	0.351	52.6	82	0.139	20.9
Mar. to Sept.											
6 a.m.,	6 p.m.	56.0	50	0.642	36.0	65	0.422	23.6	85	0.087	4.9
7 a.m.,	5 p.m.	133.5	42	0.745	106.2	55	0.576	76.8	78	0.208	27.8
8 a.m.,	4 p.m.	215.6	23	0.920	198.4	40	0.767	165.4	66	0.407	87.6
9 a.m.,	3 p.m.	247.0	12	0.979	242.0	27	0.888	219.5	56	0.559	138.2
10 a.m.,	2 p.m.	264.5	12	0.978	258.6	18	0.950	251.5	48	0.669	177.0
11 a.m.,	1 p.m.	274.6	25	0.905	248.0	17	0.957	263.0	41	0.755	207.5
12 noon		276.9	39	0.774	214.3	26	0.895	247.8	39	0.777	215.3
1 p.m.,	11 a.m.	274.6	54	0.590	162.2	40	0.769	211.2	41	0.755	207.5
2 p.m.,	10 a.m.	264.5	73	0.287	75.4	62	0.476	125.8	48	0.669	177.0
3 p.m.,	9 a.m.	247.0	64	0.442	109.1	55	0.578	142.8	56	0.559	138.2
4 p.m.,	8 a.m.	215.6	57	0.538	116.0	57	0.546	117.7	66	0.407	87.6
5 p.m.,	7 a.m.	133.5	53	0.604	80.6	62	0.467	62.1	78	0.208	27.8
6 p.m.,	6 a.m.	56.0	48	0.664	37.2	64	0.434	24.3	85	0.087	4.9
Apr. or Aug.											
6 a.m.,	6 p.m.	98.0	54	0.581	56.9	65	0.425	41.7	81	0.156	15.3
7 a.m.,	5 p.m.	196.3	41	0.750	147.3	51	0.628	123.3	70	0.342	67.1
8 a.m.,	4 p.m.	237.9	30	0.865	205.8	37	0.797	189.7	59	0.515	122.5
9 a.m.,	3 p.m.	264.4	22	0.927	245.3	23	0.923	244.0	48	0.669	177.0
10 a.m.,	2 p.m.	278.9	23	0.923	257.3	9	0.987	275.0	38	0.788	219.8
11 a.m.,	1 p.m.	284.1	31	0.857	243.8	8	0.990	281.5	31	0.857	244.0
12 noon		286.7	42	0.747	214.1	18	0.949	272.1	27	0.891	255.5
1 p.m.,	11 a.m.	284.1	57	0.551	156.8	36	0.813	231.1	31	0.857	244.0
2 p.m.,	10 a.m.	278.9	63	0.459	128.0	44	0.721	201.2	38	0.788	219.8
3 p.m.,	9 a.m.	264.4	54	0.587	155.3	44	0.723	191.3	48	0.669	177.0
4 p.m.,	8 a.m.	237.9	47	0.683	162.5	46	0.690	164.3	59	0.515	122.5
5 p.m.,	7 a.m.	196.3	42	0.745	146.4	51	0.627	123.1	70	0.342	67.1
6 p.m.,	6 a.m.	98.0	40	0.769	75.4	56	0.555	54.4	81	0.156	15.3
May or July											
6 a.m.,	6 p.m.	148.9	59	0.522	77.7	64	0.432	64.3	77	0.225	33.5
7 a.m.,	5 p.m.	211.6	47	0.687	145.3	52	0.622	131.6	67	0.391	82.7
8 a.m.,	4 p.m.	249.8	36	0.813	203.0	30	0.862	215.3	55	0.574	143.4
9 a.m.,	3 p.m.	272.1	25	0.906	246.8	22	0.924	251.8	43	0.731	199.0
10 a.m.,	2 p.m.	282.5	29	0.873	246.8	9	0.989	279.5	33	0.839	237.0
11 a.m.,	1 p.m.	288.3	36	0.806	232.4	7	0.992	286.1	24	0.914	263.5
12 noon		290.2	47	0.679	197.2	21	0.933	270.9	20	0.940	272.8
1 p.m.,	11 a.m.	288.3	60	0.506	145.8	35	0.820	236.4	24	0.914	263.5
2 p.m.,	10 a.m.	282.5	57	0.550	155.5	37	0.802	226.5	33	0.839	237.0
3 p.m.,	9 a.m.	272.1	48	0.670	182.3	36	0.809	220.1	43	0.731	199.0
4 p.m.,	8 a.m.	249.8	40	0.761	190.0	40	0.771	192.6	55	0.574	143.4
5 p.m.,	7 a.m.	211.6	35	0.823	174.3	45	0.701	148.4	67	0.391	82.7
6 p.m.,	6 a.m.	148.9	32	0.850	126.7	52	0.621	92.5	77	0.225	33.5
June											
6 a.m.,	6 p.m.	165.2	59	0.518	85.6	63	0.449	74.1	75	0.259	42.8
7 a.m.,	5 p.m.	226.5	47	0.681	154.2	49	0.656	148.5	63	0.454	102.9
8 a.m.,	4 p.m.	256.7	38	0.791	203.0	36	0.813	208.7	52	0.616	158.0
9 a.m.,	3 p.m.	275.8	33	0.839	231.1	22	0.927	255.6	40	0.766	211.2
10 a.m.,	2 p.m.	285.5	34	0.831	237.2	10	0.985	281.2	29	0.875	249.6
11 a.m.,	1 p.m.	289.8	39	0.777	225.0	9	0.987	286.0	21	0.934	270.5
12 noon		291.5	49	0.650	189.3	21	0.932	271.8	16	0.961	280.4
1 p.m.,	11 a.m.	289.8	61	0.489	141.7	35	0.821	237.8	21	0.934	270.5
2 p.m.,	10 a.m.	285.5	55	0.580	165.6	33	0.840	239.9	29	0.875	249.6
3 p.m.,	9 a.m.	275.8	45	0.705	194.0	32	0.848	234.0	40	0.766	211.2
4 p.m.,	8 a.m.	256.7	38	0.790	202.9	36	0.812	208.3	52	0.616	158.0
5 p.m.,	7 a.m.	226.5	32	0.852	193.0	41	0.754	171.0	63	0.454	102.9
6 p.m.,	6 a.m.	165.2	29	0.874	144.5	49	0.655	108.2	75	0.259	42.8

Table 12b Southeast or Southwest Wall — Latitude 45°

Solar Time		I_o	30° Slope backward			60° Slope backward			Horizontal		
S. E.	S. W.		i	cos i	$I_o$cos i	i	cos i	$I_o$cos i	i	cos i	$I_o$cos i
December											
8 a.m.,	4 p.m.	168.0	22	0.925	155.5	51	0.625	105.0	81	0.156	26.3
9 a.m.,	3 p.m.	192.7	19	0.944	182.1	49	0.656	126.4	79	0.191	36.8
10 a.m.,	2 p.m.	215.5	23	0.920	198.3	49	0.661	142.5	77	0.225	48.5
11 a.m.,	1 p.m.	251.1	30	0.868	218.0	47	0.679	170.5	72	0.309	77.6
12 noon		267.9	41	0.756	202.5	49	0.651	174.2	68	0.375	100.3
1 p.m.,	11 a.m.	251.1	55	0.567	142.5	60	0.506	127.0	72	0.309	77.6
2 p.m.,	10 a.m.	215.5	69	0.360	76.6	70	0.337	73.0	77	0.225	48.5
3 p.m.,	9 a.m.	192.7	81	0.156	30.1	81	0.165	31.8	79	0.191	36.8
4 p.m.,	8 a.m.	168.0	79	0.197	32.2	79	0.198	33.3	81	0.156	26.3
Jan. or Nov.											
8 a.m.,	4 p.m.	152.0	24	0.914	139.0	53	0.608	92.4	82	0.139	21.2
9 a.m.,	3 p.m.	216.0	17	0.956	206.5	47	0.683	147.5	77	0.225	48.6
10 a.m.,	2 p.m.	251.0	19	0.946	237.4	44	0.715	169.8	73	0.292	73.4
11 a.m.,	1 p.m.	271.0	27	0.890	241.3	43	0.731	198.0	68	0.375	101.5
12 noon		278.0	40	0.763	212.0	47	0.676	188.0	66	0.407	113.1
1 p.m.,	11 a.m.	271.0	55	0.576	156.2	57	0.549	148.9	68	0.375	101.5
2 p.m.,	10 a.m.	251.0	69	0.361	90.6	68	0.378	94.8	73	0.292	73.4
3 p.m.,	9 a.m.	216.0	82	0.142	30.7	78	0.212	45.8	77	0.225	48.6
4 p.m.,	8 a.m.	152.0	77	0.218	33.2	78	0.206	31.4	82	0.139	21.2
Feb. or Oct.											
8 a.m.,	4 p.m.	213.5	22	0.924	197.2	48	0.663	141.5	77	0.225	48.1
9 a.m.,	3 p.m.	267.9	9	0.989	264.9	38	0.787	210.9	68	0.375	100.4
10 a.m.,	2 p.m.	281.7	10	0.984	277.4	34	0.831	234.0	63	0.454	128.0
11 a.m.,	1 p.m.	291.6	24	0.915	266.8	33	0.834	243.2	58	0.530	154.5
12 noon		294.6	38	0.787	232.0	42	0.748	220.4	56	0.559	164.8
1 p.m.,	11 a.m.	291.6	52	0.611	178.2	49	0.659	192.2	58	0.530	154.5
2 p.m.,	10 a.m.	281.7	68	0.375	105.5	61	0.479	134.9	63	0.454	128.0
3 p.m.,	9 a.m.	267.9	77	0.229	61.4	70	0.349	93.4	68	0.375	100.4
4 p.m.,	8 a.m.	213.5	70	0.346	73.7	70	0.339	72.2	77	0.225	48.1
Mar. or Sept.											
6 a.m.,	6 p.m.	56.0	50	0.642	36.0	65	0.422	23.6	85	0.087	4.9
7 a.m.,	5 p.m.	117.0	33	0.840	98.3	53	0.603	70.5	79	0.191	22.3
8 a.m.,	4 p.m.	207.2	22	0.927	192.0	41	0.751	155.7	68	0.375	77.6
9 a.m.,	3 p.m.	237.9	9	0.989	235.0	30	0.867	206.1	59	0.515	122.6
10 a.m.,	2 p.m.	258.9	10	0.985	255.0	21	0.931	241.1	51	0.629	163.0
11 a.m.,	1 p.m.	267.7	24	0.917	245.7	21	0.932	249.5	46	0.695	186.0
12 noon		270.7	38	0.785	212.4	30	0.869	235.3	44	0.719	194.7
1 p.m.,	11 a.m.	267.7	53	0.595	159.3	42	0.741	198.5	46	0.695	186.0
2 p.m.,	10 a.m.	258.9	72	0.314	81.4	55	0.579	150.0	51	0.629	163.0
3 p.m.,	9 a.m.	237.9	67	0.387	91.6	63	0.457	108.7	59	0.515	122.6
4 p.m.,	8 a.m.	207.2	60	0.501	103.9	60	0.506	104.9	68	0.375	77.6
5 p.m.,	7 a.m.	117.0	54	0.583	68.2	63	0.447	52.3	79	0.191	22.3
6 p.m.,	6 a.m.	56.0	48	0.665	37.3	64	0.434	24.3	85	0.087	4.9
Apr. or Aug.											
6 a.m.,	6 p.m.	98.0	54	0.581	58.0	65	0.427	41.8	81	0.156	15.3
7 a.m.,	5 p.m.	196.3	40	0.766	150.5	50	0.639	125.6	70	0.342	67.1
8 a.m.,	4 p.m.	235.1	28	0.886	208.3	37	0.800	188.1	60	0.500	117.6
9 a.m.,	3 p.m.	260.4	18	0.951	247.5	23	0.918	239.2	50	0.643	167.5
10 a.m.,	2 p.m.	274.6	19	0.946	259.7	11	0.982	269.7	41	0.755	207.5
11 a.m.,	1 p.m.	280.8	28	0.881	247.5	11	0.980	275.0	35	0.819	230.0
12 noon		283.3	41	0.749	212.3	23	0.921	260.9	32	0.848	240.3
1 p.m.,	11 a.m.	280.8	55	0.571	160.3	37	0.801	224.8	35	0.819	230.0
2 p.m.,	10 a.m.	274.6	67	0.398	109.0	48	0.663	182.1	41	0.755	207.5
3 p.m.,	9 a.m.	260.4	57	0.538	140.1	47	0.682	177.5	50	0.643	167.5
4 p.m.,	8 a.m.	235.1	50	0.647	152.2	49	0.662	155.7	60	0.500	117.6
5 p.m.,	7 a.m.	196.3	43	0.726	142.5	52	0.617	121.2	70	0.342	67.1
6 p.m.,	6 a.m.	98.0	40	0.770	75.4	58	0.533	52.3	81	0.156	15.3
May or July											
6 a.m.,	6 p.m.	157.0	56	0.554	87.0	63	0.458	71.9	76	0.242	38.0
7 a.m.,	5 p.m.	219.6	43	0.726	159.5	48	0.665	146.0	65	0.423	92.7
8 a.m.,	4 p.m.	249.8	33	0.839	209.6	35	0.816	204.0	55	0.574	143.3
9 a.m.,	3 p.m.	269.3	25	0.905	243.7	21	0.931	251.0	45	0.707	190.4
10 a.m.,	2 p.m.	280.8	26	0.899	252.4	8	0.991	278.3	35	0.819	230.2
11 a.m.,	1 p.m.	286.1	33	0.837	239.7	7	0.993	284.2	28	0.883	253.0
12 noon		287.8	45	0.713	205.0	21	0.935	269.0	25	0.906	261.0
1 p.m.,	11 a.m.	286.1	57	0.551	157.6	33	0.841	252.5	28	0.883	253.0
2 p.m.,	10 a.m.	280.8	60	0.496	139.0	41	0.759	213.0	35	0.819	230.2
3 p.m.,	9 a.m.	269.3	52	0.622	167.7	40	0.767	206.5	45	0.707	190.4
4 p.m.,	8 a.m.	249.8	32	0.846	211.3	41	0.754	188.3	55	0.574	143.3
5 p.m.,	7 a.m.	219.6	36	0.804	176.5	45	0.709	155.8	65	0.423	92.7
6 p.m.,	6 a.m.	157.0	33	0.840	132.0	51	0.624	97.6	76	0.242	38.0
June											
6 a.m.,	6 p.m.	172.1	58	0.529	91.1	62	0.465	80.0	74	0.276	47.4
7 a.m.,	5 p.m.	226.5	45	0.702	159.0	49	0.659	149.3	63	0.454	102.9
8 a.m.,	4 p.m.	256.7	35	0.824	211.5	34	0.830	213.0	52	0.616	158.0
9 a.m.,	3 p.m.	273.4	28	0.879	240.5	21	0.936	255.9	42	0.743	203.2
10 a.m.,	2 p.m.	283.3	29	0.871	247.0	6	0.994	281.8	32	0.848	240.4
11 a.m.,	1 p.m.	287.8	36	0.814	234.3	7	0.993	285.6	25	0.906	260.7
12 noon		289.8	47	0.687	199.1	25	0.909	263.5	21	0.934	270.3
1 p.m.,	11 a.m.	287.8	58	0.523	150.7	34	0.825	237.4	25	0.906	260.7
2 p.m.,	10 a.m.	283.3	58	0.528	149.5	37	0.794	225.1	32	0.848	240.4
3 p.m.,	9 a.m.	273.4	49	0.652	178.4	37	0.800	219.0	42	0.743	203.2
4 p.m.,	8 a.m.	256.7	41	0.756	194.2	38	0.793	203.7	52	0.616	158.0
5 p.m.,	7 a.m.	226.5	33	0.835	189.2	42	0.744	168.5	63	0.454	102.9
6 p.m.,	6 a.m.	172.1	29	0.873	150.2	47	0.676	116.5	74	0.276	47.4

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Performance of Covered Hot Water Floor Panels

Part I — Thermal Characteristics

By E. L. Sartain* and W. S. Harris**, Urbana, Ill.

SUMMARY — This paper presents results of studies made in the Floor Slab Laboratory on concrete floor panels at grade levels. It contains a discussion of the effects of various floor coverings (rubber, asphalt tile, and carpetings) on the thermal characteristics of these floor panels. Data included show how the magnitude of these effects may be estimated and applied to system design. An earlier paper[1] covered heat flow characteristics of these same floor panels without coverings. Part II of this present paper is expected to discuss the room conditions produced by the covered panels.

In 1951, the Floor Slab Laboratory, described in detail in a previous paper[1], was modified to facilitate the investigation of hot-water panel-heating using 3/4-in. welded steel pipe embedded in concrete floor slabs. The Laboratory contained four test Rooms A, B, C and D with different types of floor insulation (see Reference 1, Fig. 3).

Heating System: The same hot-water, floor-panel heating-systems with bare panels[1] were used for tests with floor coverings. The panels were designed in accordance with the $I=B=R$ Installation Guide No. 6. In each room, hot water from the heater was supplied to the panel at the outside wall. Each test room was provided with its own electric water heater, watt-hour meters, circulating pump, necessary piping and controls.

Floor Coverings: At the beginning of the 1952-53 heating season rubber tile was installed on the floor of Room A and asphalt tile in Room B. Both were 9 x 9 x 1/8 in. squares and installed by a professional tile setter following the manufacturer's recommended methods, and a coat of wax was applied. Two types of carpeting and three pads were used (see manufacturers' specifications, Table 1). These carpets and pads were cut to room size and installed by professional men. Carpets and pads were selected in consultation with members of the Carpet Institute, Inc., as being representative of carpeting commonly used in modern residences.

To correlate panel performance with floor covering, the thermal conductance of the floor coverings was needed. A survey of the literature produced no official standard test procedure for determining the thermal properties of textiles, but several methods of using the hot plate apparatus have been proposed.[2,3,4]

Thermal conductances of the floor coverings were determined in a standard guarded hot-plate apparatus[5] using the test procedure outlined by the *American Society for Testing Materials*[5]. The distance between the hot and cold plates was made equal to the measured thickness of the sample as laid on the floor. The thermal conductivities of the asphalt tile, rubber tile, carpets and pads were determined by hot-plate test both individually and in combinations with results as shown in Table 1, Column 4, while the ther-

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**Research Professor of Mechanical Engineering, University of Illinois. Member of ASHAE.
[1]Exponent numerals refer to References.
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mal conductivity as supplied by the manufacturer is given in Column 5.

Instrumentation: Approximately 800 copper-constantan thermocouples were used to measure temperatures of room air, heated and unheated room surfaces, attic air, outdoor air, and water in the system. Along the center line of each room perpendicular to the north wall a large number of thermocouples were placed in the ground and under the surface of the concrete slab (see Reference 1, Fig. 3). Along these same center lines, thermocouples were located across the rooms at intervals of 6 in. on the top surface of the floor slabs and at the top surface of the floor coverings at a sufficient number of points to obtain a representative measure of the floor covering surface temperature.

In Rooms A and B thermocouples were installed flush with the top surface of the tile and others flush with the top surface of the concrete floor slab. For the rooms with carpeting, surface thermocouples were pressed slightly into the pile of the carpet. All surface thermocouples were installed so that at least 3 in. of lead wire on each side of the junction was in contact with the surface whose temperature was to be measured.[6]

Forty-four heat flow meters as developed at the ASHAE Research Laboratory[7], made and calibrated at the University of Illinois, were installed both on the top surface of the concrete floor slabs and under the gravel fill. Ten commercial heat-flow meters were installed at the edges of the floor slabs to determine edge losses. Instruments were also provided to measure relative humidity, electrical input to the immersion heaters and control circuits and water-flow rates. Continuous records of the more important temperatures and heat-flow rates were obtained from two recording potentiometers.

Operating Conditions

For all tests with bare floor panels, the electric water heaters were adjusted to a heat input rate equal to 1.3 times the estimated design heat loss of the room served. Some increases were necessary in the firing rate for the rooms in which carpets were used. A high limit control was provided in each system and for the tests with bare floor panels it was adjusted to turn off the heater whenever the leaving water attained a temperature of approximately 130 F. Higher water temperatures were required when carpeting was used, and the setting of the limit control was adjusted accordingly. Continuous operation of the circulators was used while electric water heaters were controlled by room thermostats set to maintain a temperature of 72 F at the 30-in. level.

The corridor floor was maintained at the same temperature as the adjoining test room floor by electric cables embedded in the corridor floor. Electrical input was manually controlled by variable transformers. Attic air temperature was maintained at 60 F while the air temperature in the corridor was kept approximately the same as that in the test rooms by convection heaters thermostatically controlled.

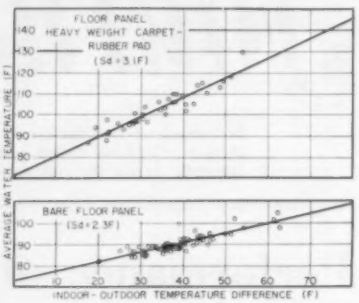


Fig. 1—Average water temperature, Room D with floor panel bare, and covered

Complete thermocouple and meter readings for each room were taken several times each day, and the more important data were recorded over 24-hr periods.

Results

Water Temperatures: Water temperatures were measured in each test room at the inlet and outlet of the coils, and the arithmetic mean of these temperatures was taken to be the average. For each room the average water temperatures for 24-hr test periods have been plotted against the corresponding indoor-outdoor temperature difference. Curves were fitted by the method of least squares. Fig. 1 shows two typical curves representative of those obtained from all test rooms. In all cases it was observed that the greater the thermal resistance of the floor covering, the greater was the increase in the average water tempera-

Table 1—Floor Covering Data

Code	Description	Used in Room	Conductance, Btuh per sq ft (F)	
			Hot plate Test	Manufacturer
Col. (1)	Col. (2)	Col. (3)	Col. (4)	Col. (5)
A. Heavy Carpet (embossed Wilton)	216 Pitch to 27 in. width 8 rows to 1 in. 3 ply wool straight yarn 2 ply wool twist yarn 2 shot; 2 frames total thickness = 0.388 in.		1.28	
B. Light Carpet (velvet twist)	216 pitch to 27 in. width 7 rows to 1 in. 2 ply wool yarn; 2 shot total thickness = 0.300 in.		1.75	
C. Heavy Pad	hair and jute 40 oz per sq yard	C	0.91	
D. Light Pad	hair and jute 32 oz per sq yard		1.27	
E. Rubber Pad	sponge rubber, smooth surface, ¼ in. thick	D	2.52	
F. Heavy Carpet & Heavy Pad		C	0.54 0.53[a]	
G. Heavy Carpet & Light Pad		A	0.64[a]	
H. Heavy Carpet & Rubber Pad		D	0.85[a]	
I. Light Carpet & Heavy Pad			0.60[a]	
J. Light Carpet & Light Pad		C	0.66 0.73[a]	
K. Light Carpet & Rubber Pad		D	1.01 1.03[a]	
L. Asphalt Tile	9 in. × 9 in. × ⅛ in.	B	19.6	36.0
M. Rubber Tile	9 in. × 9 in. × ⅛ in.	A	21.1	36.0

[a]Computed value.

ture for a given decrease in outdoor temperature.

Fig. 2 shows the relationship between the average water temperature at an indoor-outdoor temperature difference of 50 F and the thermal resistance of the floor coverings in Rooms C and D. Also indicated are the standard deviations S_d of the data from the line of regression. With the exception of the tests conducted with the 1/4-in. rubber pad, where only a relatively small number of test points were obtained, the greater the thermal resistance the larger the standard deviation.

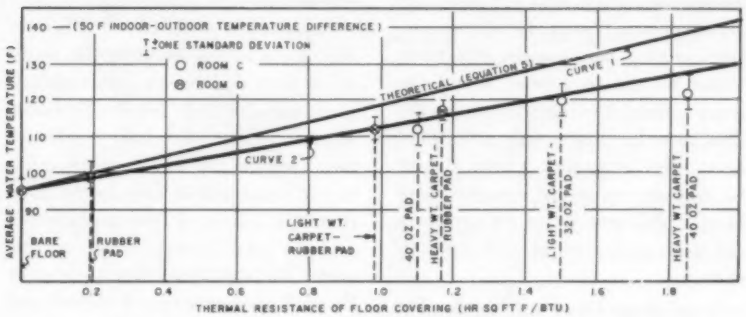


Fig. 2—Average water temperature plotted against thermal resistance of floor covering in Rooms C and D with 50 F indoor-outdoor temperature difference

The above-floor heat-output of a floor panel can be expressed in terms of an equivalent thermal transmittance and a temperature difference between water and room air, thus:

$$Q/A = U\ (t_w - t_a) \quad \ldots\ldots\ldots(1)$$

where

Q = above-floor heat-flow in Btu per hour.
A = panel area in square feet.
U = equivalent thermal transmittance from water to room air in Btu per hour, per square foot, per Fahrenheit degree.
t_w = average water temperature in Fahrenheit degrees.
t_a = room-air temperature in Fahrenheit degrees.

At 50 F indoor-outdoor temperature difference, the above-floor heat-flow per square foot of panel area in Room D was 22.8 Btuh. This value was obtained by determining the average panel surface temperature at 50 F indoor-outdoor temperature difference and the corresponding heat flow as described on pp. 116-17 of the previous paper[1]. The water temperature for tests with a bare floor panel in Room D was 96 F at 50 F indoor-outdoor temperature difference (Fig. 1). Letting R, the equivalent thermal resistance, equal $1/U$ and re-arranging Equation 1:

$$R = (t_w - t_a)/(Q/A) \quad \ldots\ldots\ldots(2)$$
$$R = (96 - 72)/22.8 = 1.05$$

For tests with floor coverings the same equation applies, and R is approximated by the equivalent resistance of the bare floor plus the resistance of the floor covering. T_w becomes the water temperature obtained with the covered panel (t_{wc}). The air temperature and heat flow remain the same. Equation 2 then becomes

$$R + R_{fc} = (t_{wc} - t_a)/(Q/A) \quad \ldots(3)$$

Substituting for R from Equation 2 yields

$$t_{wc} = (Q/A)\ R_{fc} + t_w \quad \ldots\ldots\ldots(4)$$

or for Room D

$$t_{wc} = 22.8\ R_{fc} + 96 \quad \ldots\ldots\ldots(5)$$

Equation 5 is the equation of curve 1 (theoretical) in Fig. 2. Curve 2 has been fitted to the test points.

With the exception of the tests with the bare floor panel, all the test points are below the theoretical line, and the points for Room C are the farthest removed. It is evident that the water temperature required for a material with a given thermal resistance as determined in the guarded hot-plate apparatus was less than that theoretically required. This may be the result of intermittent operation of the heater and non-steady conditions of testing. Equation 5 is based on the assumption that the concrete slab with a coil can be replaced by a slab with a plane heat source such that one-dimensional heat-flow occurs. Also, differences in the surface conditions for the carpet as tested in the guarded hot plate and as installed in the test room could have resulted in differences in overall conductance.

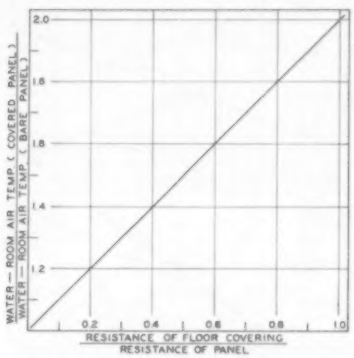


Fig. 3—Effects of floor coverings on water temperature for floor panels

Thus, it is necessary to know only the equivalent thermal resistance of the bare floor panel and the thermal properties of the floor covering used in order to predict the required water temperature for the covered panel. To make the results more general, the dimensionless ratio $(t_{wc} - t_a)/(t_w - t_a)$ was calculated. This was plotted against the dimensionless ratio of the resistance of the floor covering to the equivalent resistance of the bare panel (Fig. 3).

The relationship between the water temperatures and resistance of floor coverings (Fig. 2) was obtained at 50 F indoor-outdoor temperature difference. If straight line extrapolation to design conditions (80 F) can be assumed, it would be necessary to take the difference in water temperature for the bare and covered floor under consideration from Fig. 2 and multiply by 8/5 to obtain the water temperature difference at design conditions. The plot of Fig. 3 holds true regardless of the indoor-

outdoor temperature difference, because for two different panels the ratio of water to room-air temperature differences is equal to the ratio

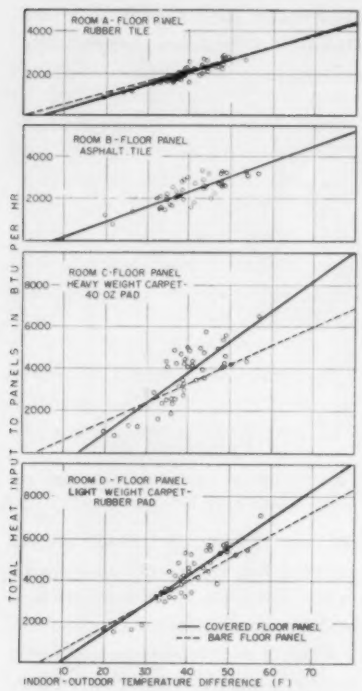

ROOM A - FLOOR PANEL
RUBBER TILE
ROOM B - FLOOR PANEL
ASPHALT TILE
ROOM C - FLOOR PANEL
HEAVY WEIGHT CARPET-
40 OZ PAD
ROOM D - FLOOR PANEL
LIGHT WEIGHT CARPET-
RUBBER PAD
COVERED FLOOR PANEL
BARE FLOOR PANEL
TOTAL HEAT INPUT TO PANELS IN BTU PER HR
INDOOR - OUTDOOR TEMPERATURE DIFFERENCE (F)

Fig. 4—Total heat input of floor panels at various indoor-outdoor temperature differences

of overall resistance of the panels which is independent of outdoor temperature.

From Fig. 2, curve 2, the average water temperature required with a heavy weight carpet and 40 oz pad at an indoor-outdoor temperature difference of 50 F is 127 F. At 80 F indoor-outdoor temperature difference (design conditions in Urbana, Ill.) the required water temperature would be 8/5 (127 − 72) + 72, or 160 F. Similarly the water temperature at 80 F indoor-outdoor temperature difference would be 110 F for a bare panel. Thus, a 50 F (160 − 110) increase in water temperature would be required when using the heavy weight carpet and 40 oz pad. If this required increase in water temperature were not taken into account in the design of a system, satisfactory performance could not be expected. Re-balancing a system in which one circuit serves a floor panel which has been covered with a floor covering having a high thermal resistance may not be possible by increasing the water temperature in the entire system and throttling down the flow of water to uncovered panels. This practice would increase the water temperature drop and decrease the effective panel area for those circuits serving bare panels. Hot areas would be apt to appear where the water enters the uncovered panels. This may be undesirable and could be avoided by proper design. It may be necessary to utilize separate zones so that different water temperatures can be maintained in different circuits.

Total Heat Input to Panels: The total energy supplied to the water in the heating system of each test room by the water heater and the circulator was measured by means of watt-hour meters. This energy, minus the heat losses from the insulated heater and connecting piping, was transferred to the panel. Since the losses from the heater and piping were negligible in comparison with the total panel output, the total energy input to the water was assumed equal to the total energy supplied to the panel[1].

Fig. 4 shows total energy supplied to the floor panel in each test room plotted against indoor-outdoor temperature difference. The curves were plotted by the least squares method. Scattering of the test points was due to uncontrollable variables, such as variations in intensity of solar radiation and wind velocity, and changes in outdoor temperature. Sufficient tests were run so that the fitted curves represent trends for average weather conditions.

Superimposed as dotted lines in Fig. 4 are curves fitted by the method of least squares to data obtained previously for bare panels[1]. In Room A, the rubber tile had practically no effect on the total energy input to the panel and it may be assumed that the effect of the asphalt tile on the total energy input to the panel also was insignificant since the thermal conductivities of asphalt and rubber tile were about the same.

Curves for Room C show that at indoor-outdoor temperature differences greater than about 30 F, the total energy input to the panel was greater for the carpeted floor than for the bare floor, while at indoor-outdoor temperature differences less than about 30 F the reverse was true. The same characteristic was shown in Room D although the difference in energy input was smaller.

The energy input to the floor panel in Room C at design conditions (80

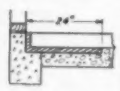
Table 2—Seasonal Energy Input to Room C (Heavy Weight Carpet, 40 oz Pad)

Avg Outdoor Temp, F	Avg No. of Days per Year	Bare Panel		Covered Panel	
		Energy Input Btu/Day[a]	Energy Input Btu/Year[b]	Energy Input Btu/Day[c]	Energy Input Btu/Year[d]
Col. (1)	Col. (2)	Col. (3)	Col. (4)	Col. (5)	Col. (6)
-10 to - 5	0.2	6,580	31,584	9,220	44,256
- 5 to 0	0.4	6,130	58,848	8,500	81,600
0 to 5	0.8	5,700	109,440	7,800	149,760
5 to 10	2.2	5,250	277,200	7,060	372,768
10 to 15	4.6	4,800	529,920	6,330	698,832
15 to 20	7.6	4,370	797,088	5,620	1,025,088
20 to 25	13.6	3,930	1,282,752	4,900	1,599,360
25 to 30	25.4	3,500	2,133,600	4,190	2,554,224
30 to 35	33.8	3,020	2,449,824	3,470	2,814,864
35 to 40	30.0	2,600	1,872,000	2,840	2,044,800
40 to 45	23.4	2,130	1,196,208	2,020	1,134,432
45 to 50	22.6	1,170	927,504	1,310	710,544
50 to 55	20.8	1,270	633,984	590	294,528
55 to 60	19.8	830	394,416	"	"
60 to 65	22.0	390	205,920	"	"
65 to 70	19.0	-	"	"	"
	Total		12,900,238 or 129 therms		13,525,056 or 135 therms

[a] From Fig. 4. [b] Col. 2 x Col. 3 x 24. [c] From Fig. 4. [d] Col. 2 x Col. 5 x 24.
(Based on records of United States Weather Bureau at the University of Illinois. Includes months of January, February, March, April, May, September, October, November, December, from September 1936 to May 1941.)

F indoor-outdoor temperature difference) was about 40 percent higher when the panel was covered by the heavy carpet and 40 oz pad than when no floor covering was used. Thus, the insulating effect of the heavy carpet and pad increased the reverse losses and heat storage as compared to operation with no floor covering to such an extent that the boiler capacity had to be increased by about 40 percent to satisfy room heat losses at design conditions. The increase in required boiler capacity when the panel was covered by a light weight carpet and ¼-in. rubber pad (Room D) was about 16 percent. No increase in boiler capacity was required for either the asphalt or rubber tile (Rooms A and B).

Table 3—Heat Losses of Floor Slabs (Btuh per lineal foot)[a]

Floor Slab	
Bare, unheated[b]	50
Bare, heated[c]	104
Light Weight Carpet, Rubber Pad, Heated	163
Heavy Weight Carpet, 40 oz Pad, Heated	240

[a] 80 F indoor-outdoor temperature difference.
[b] THE GUIDE, 1955, pp. 232-253.
[c] Reference 1.

To make this comparison it was necessary to extrapolate the curves of Fig. 4 about 20 F beyond test points. Past experience has shown that values obtained by these extrapolations are reasonably accurate.

If the distribution of outdoor temperatures for a typical winter are known, Fig. 4 may be used to estimate the effect of floor coverings on seasonal fuel consumption. Table 2 shows the estimated energy inputs (fuel consumptions) for Room C when heated by a bare panel and by a panel covered with a heavy carpet and 40 oz. pad. The difference in fuel consumption was about 6 therms per year or an increase of approximately 4.6 percent. This does not include the energy requirement for the initial warm-up period at the beginning of the season. However, unpublished test results have shown that for the most severe warm-up conditions, the energy requirements would not be more than one therm.

Heat Flow From Panels: The total heat flow from the panel as measured by heat meters located on the floor surface, under the gravel fill, and at the exposed edge of the panel were plotted in Fig. 5 against the indoor-outdoor temperature difference. For comparison the total energy input curves of Fig. 4 were reproduced as dotted lines. With the exception of Room C, the total energy input and the total heat flow from the slab were in good agreement. For Room C, at low values of indoor-outdoor temperature difference, the measured heat flow from the panel exceeded the measured energy input, while at high values of indoor-outdoor temperature difference the reverse was true.

Fig. 5 represents results of tests made after the system had been in operation long enough that the initial warm up of the ground had taken place. Also, the majority of the tests were at indoor-outdoor temperature differences ranging from 30 to 50 F with only a few tests at higher or lower indoor-outdoor temperature differences. Obviously, as water temperatures are increased to compensate for the additional heat requirements of the room resulting from a drop in outdoor temperature, an increase in the temperature of the concrete and gravel constituting the floor must result. The higher the thermal resistance of the floor covering, the greater the required change in the average floor temperature per degree change in outdoor temperature. Also, floor coverings having high thermal resistance retard the rate of change of heat flow upward into the room resulting from a change in panel temperature. Both conditions tend to accentuate differences in measured inputs and outputs, and to increase the scatter of test points for Room C.

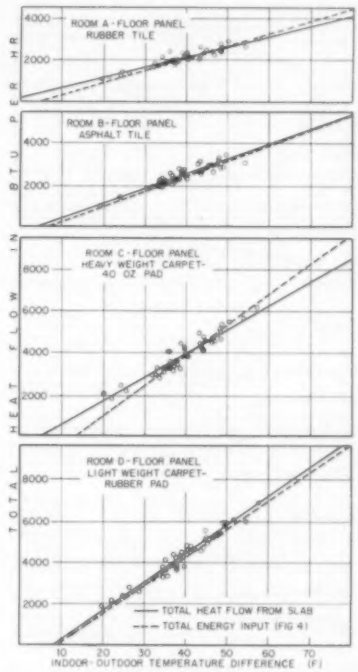

ROOM A - FLOOR PANEL RUBBER TILE
ROOM B - FLOOR PANEL ASPHALT TILE
ROOM C - FLOOR PANEL HEAVY WEIGHT CARPET- 40 OZ PAD
ROOM D - FLOOR PANEL LIGHT WEIGHT CARPET- RUBBER PAD
TOTAL HEAT FLOW IN BTU PER HR
TOTAL HEAT FLOW FROM SLAB
TOTAL ENERGY INPUT (FIG 4)
INDOOR - OUTDOOR TEMPERATURE DIFFERENCE (F)

Fig. 5—Total heat flow from panels as measured by heat flow meters at various indoor-outdoor temperature differences

Distribution of Heat Flow From Panel: Fig. 6 has been constructed from data obtained by totaling the measured heat flow from the floor panel in each room and calculating

Table 4—Application of Results

Case	Concrete Slab on Ground		
	Col. (1)	Col. (2)	Col. (3)
Floor Covering	None	Carpet and pad having a resistance of 1.0	Carpet and pad having a resistance of 2.0
Design Temperature Difference, F	80	80	80
Perimeter of House, ft	100	100	100
Design Above Floor Heat Loss, Btuh	40,000	40,000	40,000
Design Average Water Temperature, F (Based on curve 2, Fig. 2)	110	136	165
Reverse Loss at Design Conditions, Btuh (from curve 1, Fig. 7)	100 × 104 = 10,400	100 × 104 × 1.58 = 16,400	100 × 104 × 2.42 = 25,100
Total Panel Output at Design, Btuh	50,400	56,400	65,100
Panel Pick-Up Allowance, Btuh (from curves 2 and 3, Fig. 7)	0	0.054 × 50,400 = 2,720	0.19 × 50,400 = 9,590
Minimum Net Output of Boiler, Btuh	50,400	59,120	74,690

the percent of the total heat flow in each direction. Superimposed are data for uncovered concrete floor panels[1]. The curves for Rooms A and B show that the percentage distribu-

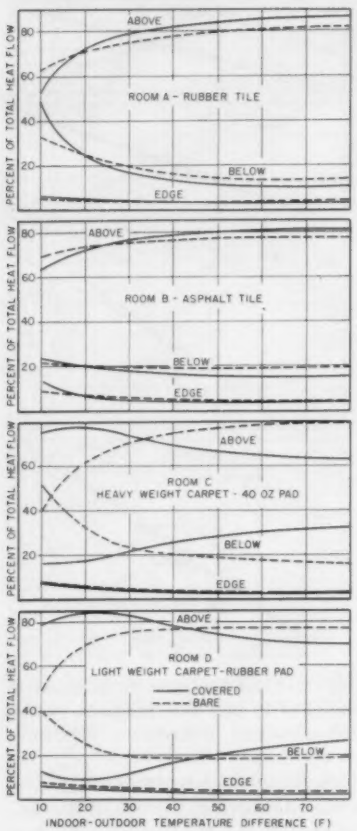


Fig. 6—Percentage distribution of heat flow from bare and covered panels at various indoor-outdoor temperature differences

tion of heat flow from the panels covered with either asphalt or rubber tile was practically the same as that for bare panels. But the curves for Room C show that placing a carpet over the panel decreased the percentage useful heat flow from the panel at indoor-outdoor temperature differences of 33 F and greater, and increased the useful heat flow at lower values of indoor-outdoor temperature difference.

The curves of Fig. 6 show comparisons of heat flow from the panel and not energy input to the panel. Because of heat storage in the panel, the two are not the same. The upward heat flow in Room C was approximately the same for both the covered and bare panel at an indoor-outdoor temperature difference of 80 F. This being the case, the increase in total heat flow from the carpeted panel in Room C was

100 × [(Upward Heat Flow/Percent of Total Upward Flow, Covered Panel) — (Upward Heat Flow/Percent of Total Upward Flow, Bare Panel)]/(Upward Heat Flow/Percent of Total Upward Flow, Bare Panel)

Using the values from Fig. 6 this equation becomes

$$100 \times [(1/0.63) - (1/0.79)]/(1/0.79)$$

which is equal to 25.4 percent of the total heat flow from the bare panel at design conditions. Previously, it was shown that carpeting the floor in Room C increased the required energy input at design conditions by 40 percent. The difference between the increase in energy input and the increase in total heat flow from the panel represents increased heat storage in the panel itself. Since heat storage is a function of the change in mean panel temperature which at design conditions was much less for the bare panel than for the covered panel, it follows that heat storage effects were also much smaller for the bare panel than for the covered panel. Increased heat storage for the covered panel was equal to the increase in energy input minus the increase in total heat flow from the panel. The increase in energy input was the difference between the two curves of Fig. 4. By assuming that the heat flow from the bare panel was equal to the energy input at design conditions, the increase in total heat flow for the covered panel is given by the difference between the total heat flow from Fig. 5 and the energy input for the bare panel from Fig. 4. By this method of analysis, the increased heat storage for the covered panel in Room C was (9550−6800) − (8550−6800), or 1000 Btuh. This estimate is conservative because the actual heat flow from the bare panel at design conditions was probably less than the energy input, which would make the increased heat storage somewhat greater than 1000 Btuh.

At design conditions the reverse losses in Room C were 37 percent of the total heat flow from the carpeted panel while for the bare panel these losses were 21 percent of the total. Since the above-floor heat-flow was

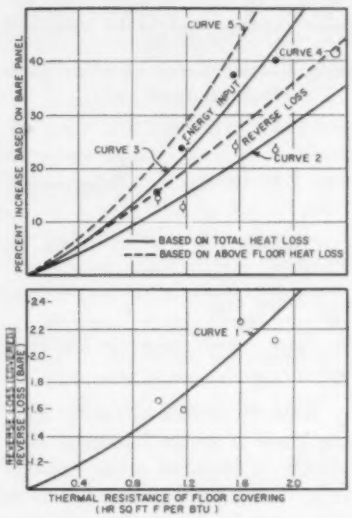

CURVE 5
CURVE 4
CURVE 3
CURVE 2
CURVE 1
ENERGY INPUT
REVERSE LOSS
BASED ON TOTAL HEAT LOSS
BASED ON ABOVE FLOOR HEAT LOSS
PERCENT INCREASE BASED ON BARE PANEL
REVERSE LOSS (COVERED) / REVERSE LOSS (BARE)
THERMAL RESISTANCE OF FLOOR COVERING (HR SQ FT F PER BTU)

Fig. 7—Effects of floor coverings on heat requirements of floor panels

the same in both cases, the reverse losses for the covered panel were

[0.37 × (Upward Heat Flow/0.63)]/[0.21 × (Upward Heat Flow/0.79)]

or about 2.2 times as large as those for the bare floor. The increase in reverse losses at design conditions was calculated for each combination of carpet and pad tested. Curve 1 of Fig. 7 shows a plot of the ratio of the reverse losses for the covered panel to the reverse losses for the bare panel *vs.* the thermal resistance of the floor coverings.

Table 3 shows the reverse heat loss for a floor slab utilizing L-type insulation as described in a previous paper[1]. Values are tabulated for unheated and heated slabs with two types of floor covering. Heat losses for the heated, covered floor panels were obtained by multiplying the heat loss for the bare panel by the value obtained from curve 1, Fig. 7.

The percentage increase in total panel output at design conditions resulting from the use of floor cover-

ings is shown by curve 2 of Fig. 7, while the percentage increase in total heat input is shown by curve 3. Since the floor covering did not affect the above-floor heat-loss of the room, the upward heat flow from the panel was unaffected by the covering. Therefore, curve 2, Fig. 7 is a measure of the increase in reverse losses from the panel, and curve 3 is a measure of the increase in reverse losses plus the increased heat storage in the panel. The effect of the floor coverings on heat storage within the panel is represented by the difference between curves 2 and 3.

To apply these results to design, it may be more convenient to express these increases in percent of upward heat flow rather than percent of total heat flow from the panel. To do so requires that the values from curves 2 and 3 be divided by 0.79 (the ratio of upward heat flow to total heat flow for the bare panel). Thus, for a given structure, if the above-floor heat-loss is calculated by the conventional method in THE GUIDE, the increase in heat storage, reverse losses, and energy input may be obtained for any thermal resistance of floor covering from curves 4 and 5.

In general, floor coverings with high thermal resistance had the undesirable characteristic of increasing the reverse losses and heat storage in the panel in cold weather. This resulted in a lower percentage of useful heat to the room, but on a seasonal basis this was compensated at least in part by an increase in the percentage of useful heat obtained during warmer weather. The heat input required to provide for heat storage in the panel is in effect a panel pick-up allowance which should be made when selecting a boiler. Also, if the increase in reverse losses is not accounted for in the heat loss calculations, additional allowance should be made in boiler sizing to compensate for the increased reverse losses.

Application of Results: To summarize the effects of floor coverings on the performance of a floor panel heating system, an illustrative example has been chosen. Three cases are presented: (1) bare concrete slab, (2) concrete slab with carpet and pad having a thermal resistance of 1.0, (3) concrete slab with carpet and pad having a thermal resistance of 2.0. For this example Table 4 shows that use of a floor covering having a thermal resistance of 1.0 requires a 26 F increase in water temperature which results in an increase in reverse loss amounting to 16,400 − 10,400 = 6000 Btuh. A floor covering having a thermal resistance of 2.0 requires a 55 F increase in water temperature which results in an increase in reverse loss amounting to 25,100 − 10,400 = 14,700 Btuh. For the floor panel with a carpet and pad having a resistance of 1.0, an additional 2720 Btuh must be provided, while for the floor panel with a carpet and pad having a resistance of 2.0, an additional 9590 Btuh must be provided for heat storage which is a pickup allowance. Therefore, the minimum net output of the boiler for the panels with coverings having resistances of 1.0 and 2.0, respectively, exceeds that for the bare panel by 8720 Btuh and 24,290 Btuh, or about 17 and 48 percent. These figures do not include the normal piping and pick-up factor. Another 30 percent is usually added to provide an allowance for piping and pick-up.

Conclusions

The following is a summary of the results obtained for the test conditions investigated:

1. Apparent thermal resistance of the bare concrete panel was about 1.05 (F per in.) per Btuh (sq ft).

2. Thermal resistance of the combinations of carpeting and pad ranged from 0.40 (F per in.) per Btuh (sq ft) for the rubber pad alone to 1.87 (F per in.) per Btuh (Sq ft) for the heavy carpet and 40 oz jute pad.

3. The thermal resistance of both the asphalt tile and the rubber tile was about 0.05 (F per in.) per Btuh (sq ft).

4. Floor coverings, such as asphalt tile or rubber tile, which have a thermal resistance of 0.2 (F per in.) per Btuh (sq ft) or less had a negligible effect on the performance of floor panel systems.

5. At design conditions, covering the floor panels with any type of carpeting had pronounced effects on the water temperatures, reverse loss from the panel, and the required boiler size (see Table 4).

6. Covering a floor panel with carpeting did not appreciably increase the seasonal fuel consumption.

7. Because of the large increase in water temperature required when a carpet is applied to floor panels it may be impossible to balance floor panel systems in which carpeting is used in some rooms only, unless the piping is arranged to permit zoning with the use of more than one water temperature.

8. Major effects of carpeting over a bare floor panel on the design and performance of a floor panel system are shown in Table 4.

Journal Section

Acknowledgments

This report concerns one phase of the panel heating research project which is part of the comprehensive steam and hot water heating investigation being conducted by the *Institute of Boiler and Radiator Manufacturers* in cooperation with the University of Illinois. Eventually, the results of this research project will be compiled in an Engineering Experiment Station Bulletin.

The authors wish to acknowledge especially the assistance of research assistants A. J. Wiegand and Liang-Neng Tao in obtaining and compiling data for this report. Also acknowledgment is made of companies contributing equipment for this study.

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SORPTION

By G. L. Simpson*, Pittsburgh, Pa.

Sorption is a fascinating subject. The sorbent materials can remove moisture from air or other gases in a way distinctly their own. Their use in air conditioning is growing fast. New applications appear constantly.

Although the action of these materials has been recognized since the 1700's, little is known concerning the background facts of the sorption process. This situation has greatly affected the activities of the Technical Advisory Committee and was one of the compelling reasons for its original formation.

A committee on Sorbents was first set up by the Committee on Research in 1942, and in 1952 the name was changed to its present form, viz, Technical Advisory Committee on Sorption.

One of the first problems attacked by the early committee was to attempt to eliminate the confusion in nomenclature which had come about with the rapid growth of the use of sorbents — a growth which began shortly after World War I. As a result definitions of "Absorbent", "Adsorbent", "Adsorption" and the general terms "Sorbent" and "Sorption" were introduced in the terminology in THE GUIDE. These words, now used with standardized meanings, were accepted after careful study of the literature and followed the lead of such authorities as McBane who, in 1909, introduced the word "Sorption" and Oswald who adopted the specific term "Adsorption".

A second general activity of the Committee has to do with the development of a standardized test code for sorbent type dehumidifiers. The need for such a code was apparent following the application of sorption equipment to the preservation of the reserve fleet following World War II. This was the well-known "Operation Moth-Ball." Thousands of automatic dehumidifiers using solid adsorbents were required. An acceptance test for these machines was worked out by the Bureau of Ships collaborating with The Pennsylvania State University, but the committee aimed at a code to provide a method of testing and rating dehumidifiers at the factory and also to test and rate them in the field. A first draft of such a code was drawn in 1949 and tests were conducted to check its suitability but it was found that field tests could not be made with the existing methods of measuring air flows. Progress in this phase awaits the development of a suitable and reliable field method of measurement of air flow. The factory testing portion of the proposed code was compared with the test procedure used by the Navy in a test at The Pennsylvania State University. The aim was to correlate the two test methods. Results are now in the process of evaluation by members of the committee. It is hoped that a code covering the factory testing procedure can be recommended shortly to the Committee on Standards of the Society.

With these activities under way, the committee had not lost sight of the desirability of improving the basc data on the nature of the sorption process. With financial contributions from almost 100 percent of the manufacturers of dehumidifiers and adsorbent materials, the Committee on Research was able to authorize a study at The Pennsylvania State University. As a result, a report of over 300 pages with graphs and tables was prepared and presented to the TAC in June 1954. The report includes a critical review of the better known theories of adsorption. The project also included an experimental investigation of the dynamic characteristics of a typical commercial desiccant and, thirdly, the formulation of a method of estimating machine performance for use in engineering design. The subject of this study was also made the basis of a paper by Ross and McLaughlin entitled "An Analysis Method for Predicting Behavior of Solid Adsorbents in Solid Adsorbent Dehumidifiers" presented at the Regional Meeting of the ASHAE at Oklahoma City, April 1955.

The results of these studies point to the need for further research not only in the field of the solid adsorbents but also in the field of liquid adsorbents. The Committee is now planning along these lines, and it is hoped that as time goes on, the lack of technical data on Sorption will be remedied.

*Chairman, ASHAE Technical Advisory Committee on Sorption.

Electric Analogue Studies of Single Walls

By Harry Buchberg*, Los Angeles, Calif.

This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, INC. in cooperation with the Department of Engineering, University of California, Los Angeles.

SUMMARY — Electric analogue studies were made of a single wall section, subjected to diurnal variation in air temperature and solar irradiation for the purpose of comparing the solutions of several different thermal circuit representations. Surface temperature and heat flux data for an insulated and uninsulated wall are presented to show the effects of lumping arrangement, fineness of lumping, and the choice of inside and outside surface conductance.

IN THERMAL CIRCUIT representation the error introduced by lumping the properties of the thermal system is a function of the fineness of the lumping, the pattern of lumping, the boundary conditions, the length of time after a change in input occurs, and the location in the network where the value of temperature or heat flux is required. Some attempts have been made to evaluate the lumping error of particular resistance-capacitance networks having simple boundary conditions using experimental[1] and analytical[2] methods. Reference 3 presents an approximate method of lumping based on filter network analysis, but further verification appears to be necessary. No attempt at generalization is available in the literature. Lacking a good analytical solution to the problem of lumping and because of the need to study different lumping arrangements in connection with the thermal circuit representation of a test house (see Reference 4), it was desirable to investigate by electric analogue solution several thermal circuit configurations of a single wall section.

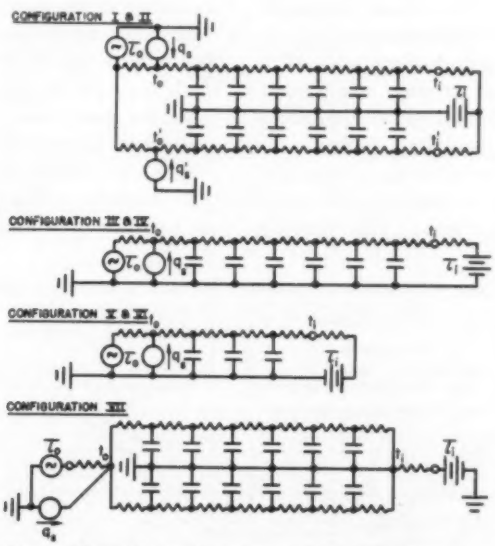

Fig. 1. Thermal circuits representing a wood frame wall section

The wall investigated is of Douglas fir frame construction, consisting of 1-in. exterior sheathing, 2- × 4-in. vertical studs placed 16 in. on center, and ¼-in. interior plywood. The studies include both an uninsulated wall and a wall insulated with standard 3-in. rockwool batts. In addition, the effects of different values of outside and inside surface conductance on surface temperature and heat flux were determined.

Electric analogue solutions of several different thermal circuit configurations, shown in Fig. 1, having identical boundary conditions are presented. The results of these solutions are given in Figs. 2 through 15 in which outside and inside surface temperatures and heat flux across the inside surface boundary are plotted as a function of time. The solar input and outside air potential were identical to those described for the west wall in the test house circuit given in Reference 4, while the inside air potential was held constant and equal to 72.5 F. The inside and outside surface-to-air resistances were based on combined radiation and convection conductances.

Symbols

- = source of constant temperature, or potential
- = source of periodically varying temperature, or potential
- = heat or current source
- = thermal resistance
- = thermal capacitance
- = ground or reference potential

The input devices used to represent the diurnal variation in air temperature and solar energy absorbed by

*Associate Engineer and Lecturer, Department of Engineering, University of California.

[1]Exponent numerals refer to References.

For presentation at the 62nd Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Cincinnati, Ohio, January 1956.

the exposed surface are described in Reference 4. Potential measurements for the solutions were made by means of a multi-channel recording oscillograph, d-c amplifier and cathode-follower inputs.

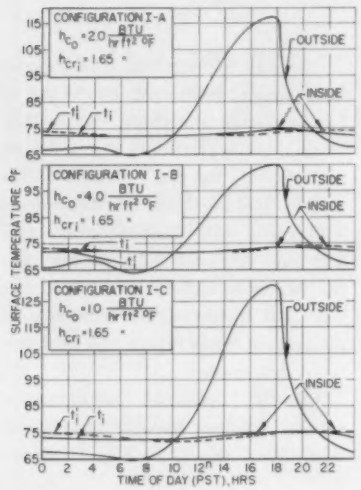

Fig. 2. Diurnal variation of surface temperatures computed with electric analogue for different values of outside conductance as noted (insulated wall)

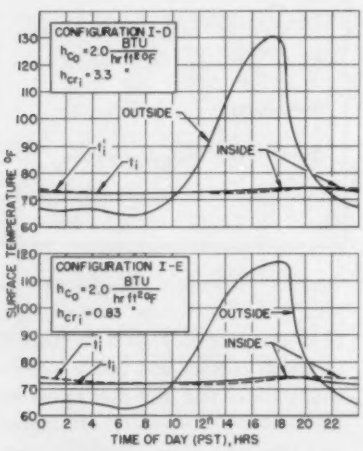

Fig. 3. Diurnal variation of surface temperatures computed with electric analogue for different values of inside conductance as noted (insulated wall)

Circuit Configurations

The methods of lumping, in the configurations studied (see Fig. 1), may be summarized as follows:

Circuit a — configuration I and configuration II: Configuration I and configuration II are identical except for the value of conduction path resistance and capacitance. The values of circuit parameters in I are based on an insulated wall and in II on an uninsulated wall or free air space between studs. This circuit represents the parallel conduction path through the space and studs. Each material in the composite structure was lumped separately in equal parts; 2 lumps for the exterior sheathing, 3 lumps for the space, 1 lump for the interior plywood sheet, 6 lumps for the path through solid wood. This lumping was considered to be the most accurate representation and all other configurations were compared with it.

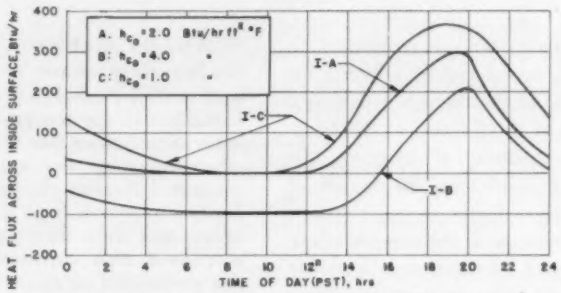

Fig. 4. Diurnal variation in heat flux across inside surface computed with electric analogue for an inside conductance of 1.65 Btu/(hr) (sq ft) (F deg) (insulated wall)

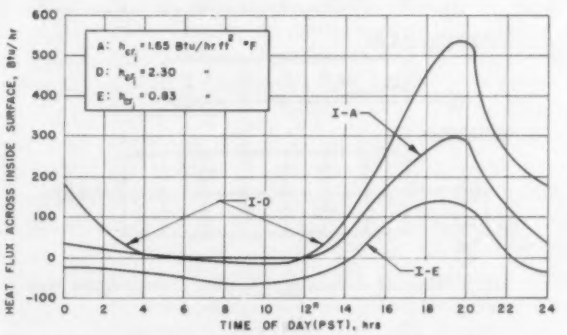

Fig. 5. Diurnal variation in heat flux across inside surface computed with electric analogue for an inside conductance of 2.0 Btu/(hr) (sq ft) (F deg) (insulated wall)

Circuit b — configuration III and configuration IV: Configuration III and configuration IV are identical except that III represents the insulated wall and IV the uninsulated wall. This is a simplified circuit consisting of only a single conduction path. There are several ways in which the circuit parameters might be determined: the resistance and capacitance of the studs could be lumped with the space, the stud area could be treated as additional air space or insulation, or the stud area neglected entirely on the basis that the heat flow through that leg of the circuit is small compared to flow through the space. For steady state, the last course would look reasonable for the uninsulated wall, but not for the insulated wall. Actually, with a periodic input the heat flow in from the stud area is significant, compared to the air space, during the night hours because of the capacitive effect. The difficulty with the first course is that the capacitive effect of the studs is weighted much too highly, introducing a significant error in the phase difference between the outside and inside sur-

face temperature cycle. The second course was, therefore, chosen and might be expected to yield slightly high values of heat flux in during the day and out during the night.

Circuit c — configuration V and configuration VI: Configuration V and configuration VI are identical in lumping and the same as III and IV, respectively, except that the number of lumps is reduced. In this case each material in the composite wall is represented by one lump.

Circuit d — configuration VII: This configuration represents an uninsulated wall accounting for the parallel flow path through the studs and space but assuming a common potential at the inside and outside surface for both paths. This configuration has the desirable advantage over II in that it reduced the number of boundary inputs required in the circuit.

Appendix A presents the values of thermal resistance and capacitance used in the different circuit configurations and a tabulation of the thermal-electrical scale factors.

Circuit Solutions

The graphs presenting the various circuit configuration solutions are grouped to illustrate the influence of several factors.

Figs. 10 *and* 11 illustrate the effect of fineness and arrangement of lumping on the outside and inside surface temperatures and on the heat flux across the inside surface boundary for the insulated west wall. As expected, the simplified configuration resulted in peak outside surface temperatures slightly lower than the basic configuration I-A, and peak inside surface temperatures slightly higher. The total cooling load predicted by the simplified lumping configuration III-A is somewhat greater than for the basic lumping, but the load predicted with a reduced number of lumps is less. The coarser lumping also tended to reduce slightly the phase lag through the wall.

Figs. 12 *and* 13 illustrate the effect of fineness and arrangement of lumping on the outside and inside surface temperatures and on the heat flux across the inside surface boundary for the uninsulated west wall. In this case the effect of considering the stud area as space is less pronounced than for the insulated wall. However, a slight decrease in outside surface temperature and a slight increase in cooling load during the day are apparent. A larger difference occurs during the night when the stud capacitance appears to aid considerably the reduction in losses at night. This is not predicted by the simplified configuration IV-A. The reduction in the number of lumps in configuration VI-A does not seem to affect the results greatly. The cooling load prediction is only slightly larger.

Figs. 14 *and* 15 compare the surface temperature and heat flux predictions of three different circuit arrangements with a relatively low value of inside surface conductance. The larger inside surface-to-air resistance had the effect of minimizing the difference between the basic configuration II-E and the simplified circuit IV-E, particularly during the

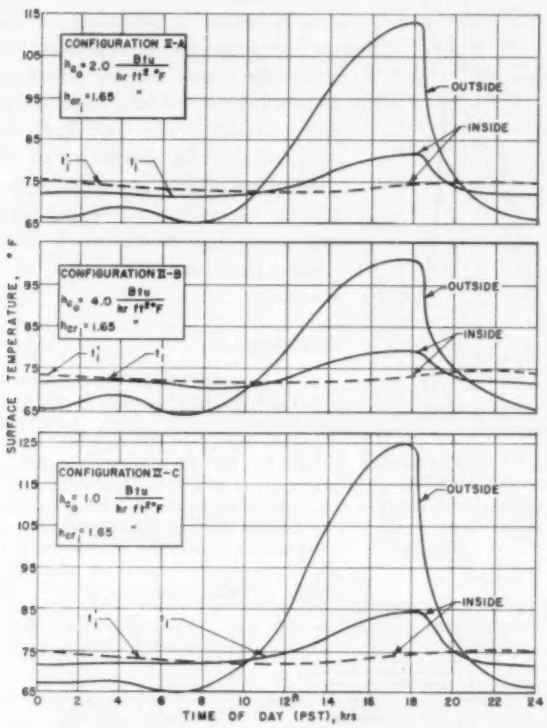

Fig. 6. Diurnal variation of surface temperatures computed with electric analogue for different values of outside conductance as noted (uninsulated wall)

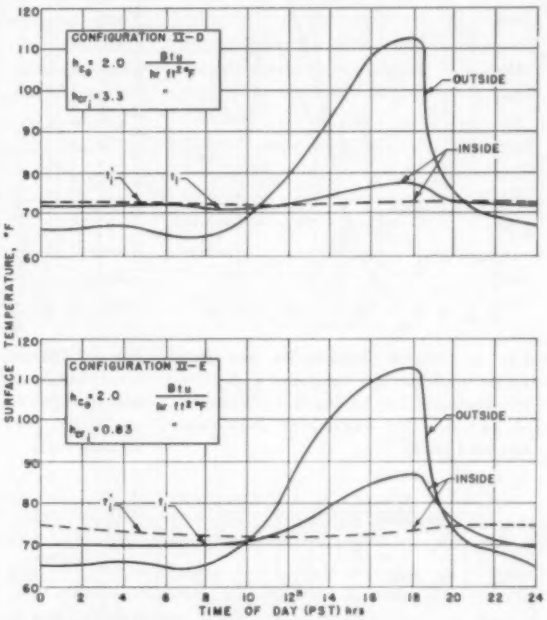

Fig. 7. Diurnal variation of surface temperatures computed with electric analogue for different values of inside conductance as noted (uninsulated wall)

night hours. The heat fluxes predicted during the afternoon by the simplified circuit are still slightly high; however, the predictions, in general, compare well with the basic circuit. Predictions of heat flux based on circuit configuration VII-E compare well with the basic circuit except during the night and early morning hours when the capacitive effect of the studs is exaggerated. This may be expected because of the short circuit of the parallel heat conduction paths at the inside surface.

Figs. 2 *through* 9 illustrate the effect of different values of inside and outside surface conductance on the surface temperatures and heat flux across the inside surface. These effects are shown for both the insulated and uninsulated west wall. These results indicate the importance of the predictions of unit thermal conductance in estimating the cooling loads and apply only to the wood frame construction represented in these studies.

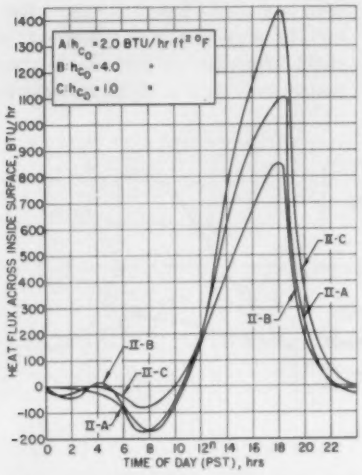

Fig. 8. Diurnal variation in heat flux across inside surface computed with electric analogue for an inside conductance of 1.65 Btu/(hr) (sq ft) (F deg) (uninsulated wall)

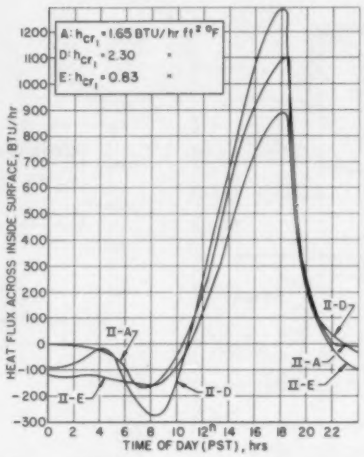

Fig. 9. Diurnal variation in heat flux across inside surface computed with electric analogue for an outside conductance of 2.0 Btu/(hr) (sq ft) (F deg) (uninsulated wall)

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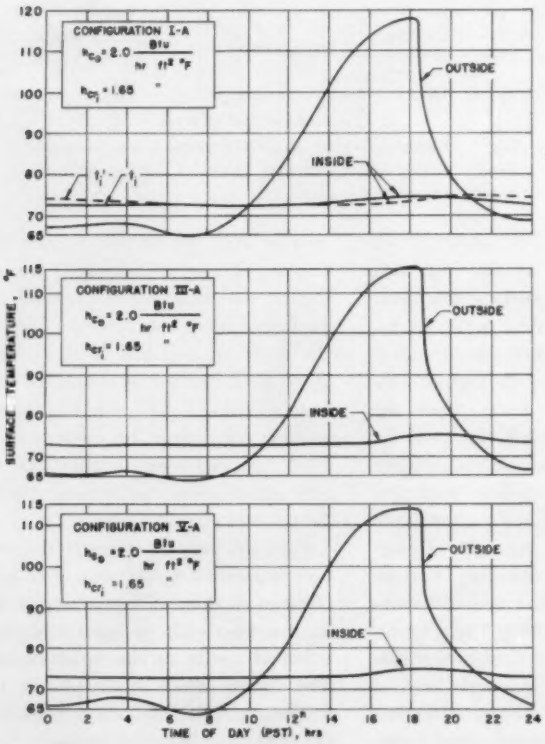

Fig. 10. Diurnal variation of surface temperatures computed with electric analogue using different lumping configurations as noted (insulated wall)

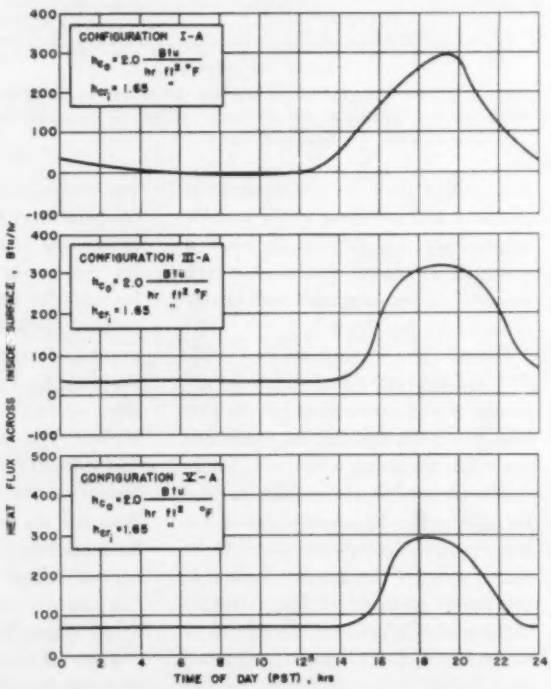

Fig. 11. Diurnal variation in heat flux across inside surface computed with electric analogue for different lumping configurations (insulated wall)

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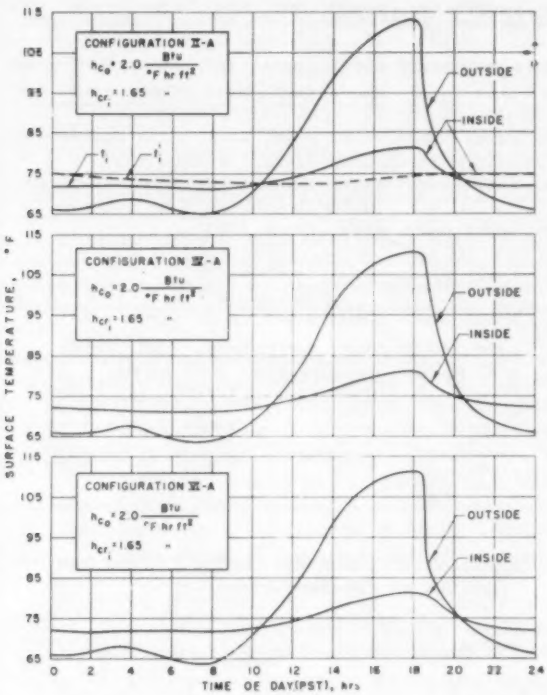

Fig. 12. Diurnal variation of surface temperatures computed with electric analogue using different lumping configurations as noted (uninsulated wall)

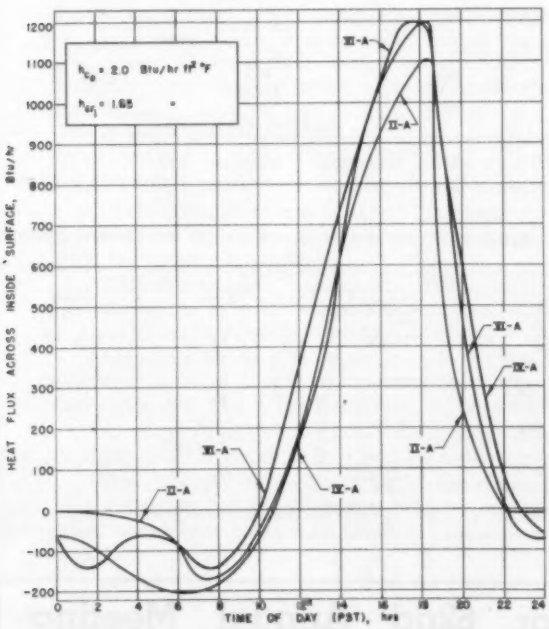

Fig. 13. Diurnal variation in heat flux across inside surface computed with electric analogue for different lumping configurations (uninsulated wall)

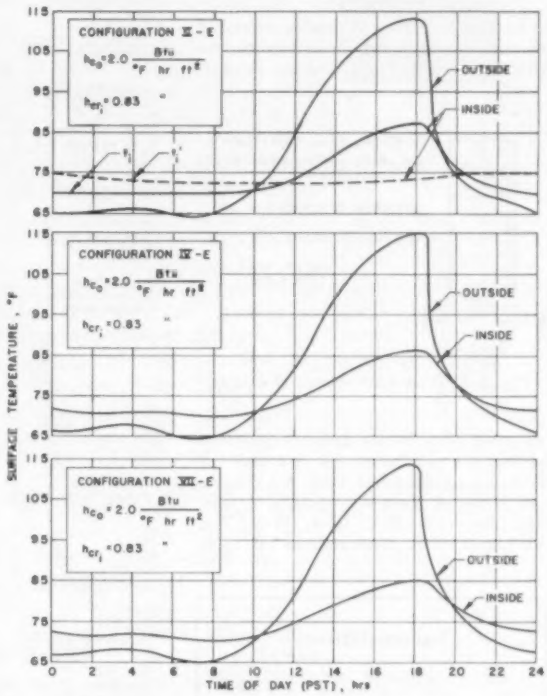

Fig. 14. Diurnal variation of surface temperatures computed with electric analogue using different lumping configurations as noted (uninsulated wall)

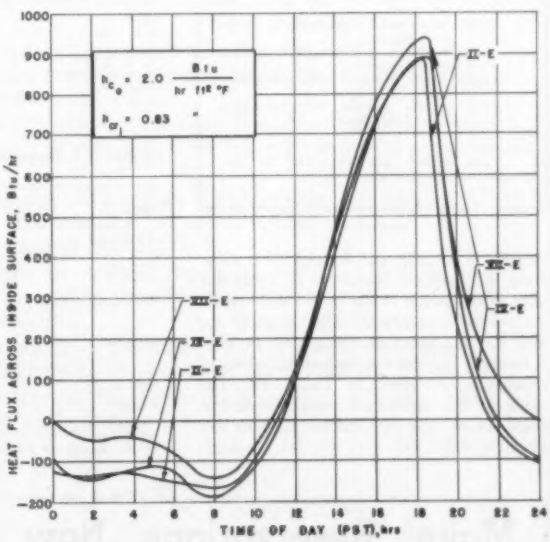

Fig. 15. Diurnal variation in heat flux across inside surface computed with electric analogue for different lumping configurations (uninsulated wall)

ing, University of California, Los Angeles, September 1954.

APPENDIX

Additional structural details, values of thermal resistance and capacitance for the circuits shown in Fig. 1, and the thermal-

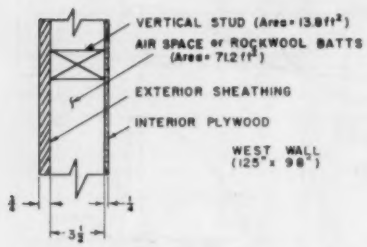

Fig. A-1. West wall structural details

electrical scale factors used are presented in Fig. A-1 and Tables A-1, A-2, and A-3. It should be noted that Table A-1 presents the values of thermal resistance for configurations I-A, II-A, III-A, IV-A, V-A, VI-A, and VII-E. Configurations I-B, C, D, and E; II-B, C, D, and E; and IV-E differ from the basic configurations in Table A-1 only in the values of the inside and outside surface-to-air resistance. The values of h_{co} and h_{cri} are given on the graphs in Figs. 2 through 15; the corresponding values of resistance are given in Table A-1. The value of h_{ro}, equivalent outside radiation conductance, was constant for all runs and equal to 0.917 Btu/(hr) (sq ft) (F deg).

Nomenclature*

h_{co} = unit thermal conductance at outside surface, Btu per (hour) (square foot) (Fahrenheit degree).
h_{cri} = equivalent unit thermal conductance at inside surface, Btu per (hour) (square foot) (Fahrenheit degree).
q_s = solar input, or solar energy absorbed by the exposed surface, Btu per hour.
t_i = inside surface temperature, Fahrenheit degrees.
t_o = outside surface temperature, Fahrenheit degrees.
τ_i = inside ambient air temperature, Fahrenheit degrees.
τ_o = outside ambient air temperature, Fahrenheit degrees.

*The primed quantities refer to the path through the studs.

Table A-1. Values for Resistances of Circuits Shown in Fig. 1 [*Going from left to right, (Fahrenheit degree) (hour) per Btu*]

Configuration I-A	1	2	3	4	5	6	7	8	9
Top Row (Insulation Path)	0.00481	0.00338	0.00675	0.0306	0.0545	0.0545	0.00295	0.0225	0.0085
Bottom Row (Stud Path)	0.0248	0.0348	0.0697	0.0697	0.0697	0.0697	0.0697	0.0348	0.0440

Configuration II-A	1	2	3	4	5	6	7	8	9
Top Row (Air Space Path)	0.00481	0.00338	0.00675	0.00533	0.00390	0.00390	0.00420	0.00225	0.0085
Bottom Row (Stud Path)	0.0248	0.0348	0.0697	0.0697	0.0697	0.0697	0.0697	0.0348	0.0440

Configuration III-A	1	2	3	4	5	6	7	8	9
	0.00403	0.00283	0.00565	0.0256	0.0456	0.0456	0.0247	0.00189	0.00712

Configuration IV-A	1	2	3	4	5	6	7	8	9
	0.00403	0.00283	0.00565	0.00446	0.00327	0.00327	0.00352	0.00189	0.00712

Configuration V-A	1	2	3	4	5	6
	0.00403	0.00565	0.0742	0.0704	0.00189	0.00712

Configuration VI-A	1	2	3	4	5	6
	0.00403	0.00565	0.01055	0.00679	0.00189	0.00712

Configuration VII-E	1	2	3	4	5	6	7	8	9
Top Row	0.00403	0.00338	0.00675	0.00533	0.00390	0.00390	0.00420	0.00225	0.01418
Bottom Row		0.0348	0.0697	0.0697	0.0697	0.0697	0.0697	0.0348	

Configuration	Surface to Air Resistance, (Fahrenheit degree) (hour) per Btu			
	1 (Top)	1′ (Bottom)	9 (Top)	9′ (Bottom)
I and II -A	0.00481	0.0248	0.00850	0.0440
-B	0.00288	0.0149	0.00850	0.0440
-C	0.00735	0.0379	0.00850	0.0440
-D	0.00481	0.0248	0.00425	0.0220
-E	0.00481	0.0248	0.01692	0.0874
IV-A	0.00403		0.00712	
IV-E	0.00403		0.0142	

Table A-2. Values for Capacitances of Circuits Shown in Fig. 1 (*Going from left to right, Btu per Fahrenheit degree*)

Configuration	Exterior Sheathing					Interior Plywood
			Insulation			
I Top Row (Insulation Path)	37.8	37.8	13.9	13.9	13.9	20.1
			Air Space			
II & VII Top Row (Air Space Path)	37.8	37.8	0.118	0.118	0.118	20.1
			Insulation			
III	45.1	45.1	16.6	16.6	16.6	30.0
			Air Space			
IV	45.1	45.1	0.141	0.141	0.141	30.0
			Insulation			
V		90.2		49.8		30.0
			Air Space			
VI		90.2		0.423		30.0
	Solid Path of Douglas Fir					
I, II, & VII Bottom Row (Stud Path)	14.7	14.7	14.7	14.7	14.7	14.7

Table A-3. Summary of Ratios and Units of Analogous Electrical and Thermal Qualities

Quantity	Units		Scale Factors	
	Thermal	Electrical	Ratio	Value
Time	hrs	sec		2
Capacity	$\frac{\text{Btu}}{\text{F deg}}$	Farads	$\frac{C_t}{C_e}$	8×10^6
Resistance	$\frac{\text{F deg}}{(\text{Btu/hr})}$	Ohms	$\frac{R_e}{R_t}$	16×10^6
Potential	F deg	Volts	$\frac{E}{t - t^*}$	1
Rate of Energy Transfer	$\frac{\text{Btu}}{\text{hr}}$	$\frac{\text{Coulombs}}{\text{sec}}$ or Amperes	$\frac{q}{i}$	16×10^6

t^* = Reference temperature. Subscripts: t = thermal circuit element; e = electrical circuit element.

Make Reservations Now for 62nd Annual Meeting
Cincinnati, Ohio—January 23-25, 1956

THE PRESIDENT'S PAGE

Society Chapters

TEN years ago on September 2, 1945, Japan surrendered, formally bringing an end to World War II.

The United States and Canada closed down their war production and promptly launched into what has been a decade of tremendous growth.

Nearly every area of the national economies has doubled or tripled and the heating and air-conditioning industry has been in the forefront in the progress which has taken place.

It was only proper, therefore, that our Society not only kept in step with the growth in our field, but also furnished its leadership during this period of tremendous expansion.

At the beginning of 1945 the Society had about 3800 members and 37 chapters. Today, we have more than 10,000 members and 60 chapters. The 61st chapter in Baton Rouge, La., will receive its charter this fall.

The chapters have played a very important part in the continued growth and progress of the Society. Today, about 70 percent of the Society members are also chapter members, and this percentage increases each year as more chapters receive their charters.

The Illinois Chapter was the first to receive its charter in 1906, nearly fifty years ago. The number of chapters increased to eleven by 1920 and to twenty by 1935.

It has been estimated that the attendance of members at chapter meetings during 1955 will exceed 25,000 and this total of member attendance at meetings of the chapters is about ten times the member attendance at Society Annual and Semi-Annual Meetings.

Therefore, the opportunities for advancement of the arts and sciences with which the Society is concerned, for dissemination of knowledge and information, for cooperation with others, and fulfillment of other purposes of the Society are truly great at the chapter level.

These opportunities are further enhanced through the more personal character of relationship at the chapter level, naturally engendered by closer associations and more intimate friendships.

The force and impact of the Society in pursuit of its purposes is therefore greatly multiplied through its chapters. Accordingly, improvement in chapters toward more conscious devotion to the purposes of the Society cannot but bear fruit desirably in the public interest.

I have had the distinct pleasure of visiting more than forty chapters during the past two years and all of these chapters, without exception, are growing in size, broadening their activities, and providing greater benefits for their members and their communities. It is very encouraging.

This year, fifteen chapters are issuing publications of various sorts ranging from one to several pages. These publications contain announcements of the next meeting, a report of the previous meeting, local Society news, national Society news, news about the members and other items of interest.

A check on the readership of these publications indicates that nearly every word is read by nearly every member. Therefore, these publications provide a service for the members which increases their interest in chapter and Society affairs.

Several chapters are assisting local and state authorities in writing heating, ventilating, and air-conditioning codes. This is not only permissible, but very desirable when a request is received from the proper authority.

Several chapters have provided speakers for local service groups, associations, and other engineering societies who tell the story of heating and air conditioning and the part that ASHAE has played in advancing the arts and sciences of this complex subject.

Although heating in some form has been in use for several thousand years, and air conditioning has been practiced for more than fifty years, our profession is comparatively new, and there are still many fundamentals to be determined.

As a result of research and the proper dissemination of the information gained from research, heating and air conditioning will be much better and more efficiently accomplished in the future.

The chapters of the Society provide a means to permit the proper dissemination and use of this information to the members, the industry and the general public.

J. E. Haines

President

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Listen ASHAE's
The Queen City Calls

Union Station, Cincinnati

If you nefer vas in Zinzinnati here is your opportunity — come to the 62nd Annual Meeting of the ASHAE at the Sheraton-Gibson Hotel, January 23-25, 1956. You will be so glad you did!

The program, planned by the Society's Program and Papers Committee, with the Committee on Arrangements of the Cincinnati Chapter, will provide plenty of solid technical material and satisfying entertainment for this three day meeting.

John E. Haines, president of the Society, will open the meeting on Monday, January 23, and the principal business will be the presentation of the officers' reports, the report of Council, the report of the Committee on Research, and the discussion and vote on proposed amendments to the By-Laws. Members will receive through the mail with the official notice of the meeting, copy of the amendments dealing with membership grades, the new regional plan of Chapter operations, a change in the time of selection of the Guide Committee, a revision of the Nominating Committee procedure.

These proposed amendments involve changes in **Article II,** *Sections 1, 2* and *3(a), (d), (f), (h), 4, 5, 6* and *8(a)*. These changes if approved will bring ASHAE membership qualifications and grades in harmony with ECPD recommendations.

Articles III, IV, V, VII deal with Chapters, Special and Student Branches and Regional Areas, Funds, etc. The new committees to be created are a Region's Central Committee and 7 Chapters Regional Committees with 7 of the Council members elected to serve as Regional Directors. These committees would replace the present Chapter Relations Committee and the Chapters Conference Committee.

Article VIII, *Section 3*, would change the Nominating Committee of 11 members and 2 alternates to 11 members and 16 alternates selected by the Council and the Chapters Regional Committee.

Council has endorsed these amendments and copies will be sent to members eligible to vote with proxy ballots as required by the By-Laws.

There will be eight sessions at Cincinnati including Symposium discussions on the subjects of High Velocity Air Distribution and Air Pollution. Among the other important subjects are papers on: Humidity Effects on Odors, Panel Heating Design Procedure, Performance of Floor Panels, Equipment and Water Flow Noises, Solar Radiation, Evaluation of Heat Stress, Body Evaporation in Various Temperatures, Humidities, Air Pressures and Velocities, Dual-Duct Design and High Velocity Air Conditioning for Multi-Story Buildings. Several papers from the ASHAE Research Laboratory and cooperating universities are featured on the program.

To make early hotel reservations a special form is being mailed to all members. It must be filed with the Housing Bureau of the Cincinnati Convention and Visitors Bureau. The hotels will be listed with prevailing rates and members should indicate their first, second and third choice in order to get the type of accommodations that they want.

The work of the local Chapter Committee on Arrangements is being directed by A. W. Edwards, general chairman, assisted by H. E. Sproull, honorary chairman, H. E. Russell, vice chairman, and the following eight sub-committee chairmen: *Reception* — F. W. Wilson; *Ladies* — R. C. Beineke; *Entertainment* — C. P. Krantz; *Banquet* — E. A. Sobolewski; *Finance* — E. W. McNamee; *Publicity* — R. G. Anderson; *Sessions* — H. W. Moore; *Transportation* — N. A. Frankel, Jr.

In addition to several inspection trips there will be special events for the members and their families. A reservation form for these special features will come through the mail to all members. There will be an attractive program for the ladies including a Welcome Tea on Sunday afternoon, a fashion show and luncheon at the Cincinnati Club, a tour of the Art Museum, Taft Museum and the Flower Conservatory with luncheon at the Alms Hotel.

A get-together luncheon will be held at the Sheraton-Gibson Monday at noon and on Monday evening the group will have dinner and enjoy the floor show entertainment at the

Beverly Hills Country Club across the Ohio in Kentucky.

Tuesday evening there will be a showing of colored slides made by members on their travels.

The closing social event will be the annual banquet on Wednesday evening at the Sheraton-Gibson.

All roads lead to Cincinnati in January. The Queen City is served by American, Allegheny, Piedmont, Delta, C & S, TWA and Lake Central Airlines and by the B & O, C & O, New York Central, Pennsylvania, L & N, Norfolk & Western and Southern Railroads. The accompanying table gives typical railroad, pullman and airlines rates from principal cities.

Members coming from the east, west, north and south will find Cincinnati a fascinating city as it has much of cultural and historic interest to offer the visitor.

The Taft Museum, on Pike Street just off Fifth, was built over 125 years ago. A historical landmark, it is particularly noted for its collection of Chinese porcelain and noteworthy paintings, primarily the work of English masters.

Tyler-Davidson Fountain with Carew Tower in background. Distances are measured from Fountain Square, which divides Fifth Street into two lanes between Vine and Walnut Streets

A visit to the Cincinnati Art Museum can include a bit of adventurous travel, if the Zoo-Eden street car is used. It is the only inclined-plane railway still remaining in Cincinnati. The incline goes up the side of Mt. Adams, a height which was the site of an early observatory. The street cars are run onto a platform which is hauled along some 945 feet of steep tracks. As one trolley goes up it is counterbalanced by another coming down.

The Art Museum has two floors of exhibit space and a library of several thousand books on art. Although there is a large collection of paintings exhibited, the specialty of the Museum is sculpture.

Business and pleasure can be combined at the ASHAE Annual Meeting, January 23-26. Look at the program, look at the map and make your reservations early.

Transportation Rates To Cincinnati From Chapter Cities

City	1st Class Round Trip By Rail*	One Way Roomette*	Round Trip By Air*	City	1st Class Round Trip By Rail*	One Way Roomette*	Round Trip By Air*
Albany, N.Y.	$62.75	$10.60	$71.00	Milwaukee, Wis.	$31.30	$ 7.00	$42.90
Albuquerque, N.M.	98.15	22.45	156.70	Minneapolis, Minn.	50.05	9.15	77.70
Atlanta, Ga.	33.35	7.65	48.30	Montreal, Canada	65.25	12.50	103.10
Austin, Tex.	71.35	17.10		New Orleans, La.	54.50	12.50	93.00
Baltimore, Md.	47.90	8.20	55.10	New York, N.Y.	63.75	10.60	71.00
Boston, Mass.	80.91	16.20	88.30	Norfolk, Va.	64.45	9.15	60.30
Buffalo, N.Y.	38.05	7.00	51.20	Oklahoma City, Okla.	60.15	15.65	94.20
Charlotte, N.C.	45.90	15.20	50.50	Omaha, Nebr.	54.95	11.55	81.20
Chicago, Ill.	26.30	7.00	33.50	Ottawa, Canada	57.05	9.65	92.20
Cleveland, Ohio	22.75	7.00	28.50	Philadelphia, Pa.	56.05	10.60	64.70
Columbia, S.C.	41.35	9.65	58.20	Phoenix, Ariz.	125.00	27.85	199.40
†Columbus, Ohio	10.38	0.95	16.80	†Pittsburgh, Pa.	27.25	7.00	35.60
Dallas, Tex.	60.70	14.40	106.40	Portland, Ore.	139.55	32.60	249.60
Dayton, Ohio			8.60	Sacramento, Calif.	143.90	32.60	244.10
Denver, Colo.	83.60	17.10	139.60	St. Louis, Mo.	30.45	7.00	39.70
Des Moines, Ia.	47.20	10.60	67.30	Salt Lake City, Utah	112.30	24.50	
Detroit, Mich.	22.75	7.00	30.50	San Antonio, Tex.			134.30
Grand Rapids, Mich.	27.40	7.00	35.60	San Francisco, Calif.	143.90	32.60	244.10
Greensboro, N.C.	43.20	10.60	43.70	Seattle, Wash.	139.55	32.60	249.60
Hartford, Conn.	72.07	16.20	79.20	Shreveport, La.			93.00
Houston, Tex.	69.55	16.70	118.70	Spokane, Wash.	123.35	28.25	224.70
Indianapolis, Ind.	9.90	0.95	14.50	Springfield, Mass.	72.07	11.55	79.20
Jackson, Miss.	43.80	9.90	76.20	Syracuse, N.Y.	50.20	9.15	66.10
Kansas City, Mo.			66.60	Toledo, Ohio	17.68	7.00	23.00
Little Rock, Ark.			79.10	Toronto, Canada	39.20	8.20	56.40
Los Angeles, Calif.	143.90	32.60	235.40	Tulsa, Okla.	55.25	14.65	81.20
Louisville, Ky.	8.40	0.95	12.50	Vancouver, B. C.			266.70
Lubbock, Tex.	82.70	19.75	135.10	Washington, D.C.	47.35	8.20	50.40
Memphis, Tenn.	31.45	8.20	53.80	Wichita, Kans.	59.15	15.20	78.80

*Does not include 10% Federal Transportation Tax.

†Fares shown are first class; however, coach service only is available via Baltimore & Ohio.

Nominations for 1956

In accordance with the provisions of the Society's By-Laws, proxy ballots containing the names of the candidates will be sent to the membership prior to the Annual Meeting in January.

Report of Nominating Committee

The Nominating Committee, selected in accordance with the provisions of **Article VIII**—*Section* 3 of the By-Laws, has submitted the following nominees for Officers and members of Council for 1956:

President
JOHN W. JAMES, Chicago, Ill.

First Vice President
P. B. GORDON, New York, N. Y.

Second Vice President
E. R. QUEER, University Park, Pa.

Treasurer
R. A. SHERMAN, Columbus, Ohio

Members of Council (*Three-Year Term*)

A. B. ALGREN, Minneapolis, Minn.
JOHN EVERETTS, JR., Philadelphia, Pa.
J. N. LIVERMORE, Detroit, Mich.
J. H. ROSS, Toronto, Ont., Canada

Respectfully submitted,
NOMINATING COMMITTEE

B. L. Evans, *Chairman*
W. O. Stewart, *Secretary*

F. W. Brundage — A. B. Newton
W. J. Collins, Jr. — W. B. Pennock
E. L. Crosby — J. D. Slemmons
J. D. Kroeker — R. L. Stinard
G. D. Winans

Alternates
W. G. Hole — C. A. Linskie

Council Nominees for Committee on Research

The election of the Committee on Research is governed by the By-Laws for the election of Officers, with the exception that members of the Committee on Research are nominated by the Council.

In accordance with the provisions of **Article VII** — *Section* 3 (*h*) the Council announces the nomination of the following members of the Committee for election to succeed those members whose present terms expire January 1956.

Committee on Research (*Three-Year Term*)

F. H. FAUST, Bloomfield, N. J.
F. K. HICK, M.D., Chicago, Ill.
R. C. JORDAN, Minneapolis, Minn.
H. A. LOCKHART, Morton Grove, Ill.
ARTHUR NUTTING, Louisville, Ky.

By-Law Provisions on Nominations and Voting

Article VII

Section 3. General Committees. .....
(*h*) *Committee on Research*, consisting of fifteen (15) MEMBERS, nominated by the Council or as provided in *Article VIII, Section 4*, and elected by the Society in the manner of elected officers. .....

Article VIII

Section 4. Other Nominations. Nominations of officers and members of the Council, other than those nominated by the Nominating Committee, and nominations of members of the Committee on Research, other than those nominated by the Council, may be made in writing by at least fifty (50) members eligible to vote, upon presentation of such nominations, with each nominee's consent, to the Executive Secretary at least sixty (60) days prior to the opening of the first session of the Annual Meeting, whereupon the nominees' names shall be placed upon the ballot with a notation that they are presented by members independent of the Nominating Committee.

Section 5. Voting. Voting at any meeting may be in person or by proxy, but only the Executive Secretary and MEMBERS of the Society shall be eligible to act as proxies. Proxies shall not be valid for more than three (3) months from dates of execution. The Executive Secretary and the MEMBERS acting as proxies shall hold the ballots of their principals secret and confidential. Voting for election of officers, Council members, members of the Committee on Research, on proposals to amend these By-Laws, and on questions required to be referred to the Society pursuant to *Article V, Section 2*, shall be by secret ballot. In the event of any tie vote, the Council shall decide the vote.

Section 6. Ballots. Together with notice of the Annual Meeting, the Executive Secretary shall forward appropriate proxies and ballots to members entitled to vote. The proxies and ballots shall contain spaces for write-in names.

Biographies of 1956 Nominees

Officers

For president—JOHN W. JAMES, vice president of research, McDonnell & Miller, Inc., Chicago, is known to many Society members for his service as technical secretary, 1935-43. First vice president this year, Mr. James previously served as second vice president, 1954, and treasurer, 1953.

Mr. James received his B.S. in mechanical engineering from Oregon State College in 1928. Following four years of association with a consulting engineer in Portland, he accepted a research fellowship at the University of Wisconsin, gaining his M.S. in 1934. He worked in the laboratory of the General Electric Co. in Schenectady, N.Y., acted as research adviser and instructor at the Polytechnic Institute of Brooklyn and participated in

John W. James
Chicago, Ill.

design and development work with Iron Fireman Manufacturing Co., Cleveland, previous to joining the McDonnell & Miller organization.

Elected a junior member of the Society in 1933, Mr. James advanced to full member in 1937. In 1950 he began a three-year term on the Council, where he served as chairman of the Program and Papers Committee in 1949, chairman of the Finance Committee in 1954, and is at present chairman of the Executive Committee. He was elected to two terms on the Committee on Research, serving as vice chairman in 1949, held membership on the TAC on Panel Heating and Cooling, has been chairman of the TAC on Hot Water and Steam Heating since 1950, and is a member of the TAC on Physiological Research. He is currently chairman of the F. Paul Anderson Committee and a member of the Long-Range Planning and Public Relations Committees. He has also worked on the Long-Range Research Program, Publication, Constitution and By-Laws, Nominating, Publication Policy, and Guide Committees.

A registered professional engineer in the States of Oregon and Ohio, Mr. James is a member of Sigma Xi, Pi Tau Sigma, Phi Sigma Kappa, *Western Society of Engineers, Gas Appliance Engineers Society*, and *American Society of Sanitary Engineers*, and is listed in *Who's Who in America*. He is active on the Research Committee of the *National Association of Manufacturers*, and is a member of *ASME*, serving on its Heating Boiler Code Subcommittee.

Mr. James was a contributor to the 12th edition of *Kent's Mechanical Engineers' Handbook* and associate editor of the 1951 edition of the *Handbook of Oil Burning*. He served as technical editor of THE GUIDE from 1936 to 1943, and is co-author of the textbook, *Heating and Air Conditioning*, by Allen, Walker and James.

For First Vice President—P. B. GORDON, vice president, Wolff and Munier, Inc., New York, who is now ASHAE second vice president, became a junior member of the Society in 1935, advancing to full member in 1944. He served a three-year term on the Council beginning in 1952.

While an undergraduate at Rutgers University, Mr. Gordon began work as a

P. B. Gordon
New York, N. Y.

draftsman and estimator. After graduating with a B.S. in civil engineering in 1928, he worked with a New Brunswick contractor for a year. He then joined George E. Gibson Co., New York, later assuming charge of the heating and ventilating department. From 1936 on he has been connected with Wolff and Munier, Inc., acting as engineer, treasurer and director previous to gaining the vice presidency in 1951.

Mr. Gordon also has given courses in air conditioning at Brooklyn Evening Technical High School, was an instructor and adjunct associate professor at New York University Evening Engineering Division, and was a visiting lecturer in mechanical engineering at Princeton University.

Active on various Society committees, Mr. Gordon has served the following: the Guide Publication Committee, as member from 1949-50 and chairman in 1951; TAC on Panel Heating and Cooling, as member, 1947-49, and chairman, 1949-55; Standards Committee, as member, 1952-53, and chairman in 1954; Program and Papers Committee, 1952-53; Building Committee, 1953-55; and Ways and Means Committee in 1954. He has been a member of the ASHAE-*ASRE* Joint Committee since its inception last year. Presently, he is also a member of the Executive Committee, and chairman of the Chapter Relations and Long-Range Planning Committees, having served as a member of the latter from 1953-54.

Mr. Gordon also holds membership in *ASME*, *ASRE*, *ASEE* and the Chemist's Club of New York.

For Second Vice President—E. R. QUEER, director and professor of engineering research, The Pennsylvania State University, University Park, Pa., has served as treasurer of the Society

E. R. Queer
University Park, Pa.

for the past two years. From 1950-53 he was a member of the Council.

He studied electrical engineering at Pennsylvania State College, receiving his B.S. in 1926 and M.S. in 1928. Professor Queer has been associated with the College of Engineering and Architecture in the field of research since graduation, serving on the faculty since 1926, and as director of engineering research since 1952. He has conducted extensive research, particularly in the fields of heat and moisture transfer, thermo-dynamics, adsorption by chemical desiccants, and in housing. He is the author of a number of bulletins and technical papers.

Professor Queer has held the position of captain in the U.S. Naval Reserve since 1952. During World War II, he served for five years in the Air Conditioning Section of the Bureau of Ships, receiving commendations from Adm. C. W. Nimitz and J. A. Forrestal, Secretary of the Navy. He now acts as a consultant to the Chief of Army Ordnance, the Bureau of Yards and Docks of the U.S. Navy, The U.N. Permanent Headquarters on condensation control in the United Nations Buildings, and several companies on long-term storage and preservation of military material, on thermal insulation, and on protective coatings.

Since he joined the Society in 1933, he has been on various committees, among

which were the Technical Advisory Committees on Navy Studies, and on Air Sterilization, 1948, and on Insulation, 1939-49. He has been a member of the TAC on Human Calorimetry since it began in 1949 and of the ASHAE-*ASRE* Joint Committee and the Executive Committee for the past two years. Since 1952 he has worked on the Ways and Means and Finance Committees, serving as chairman for the former in 1953 and for the latter this year. He also served on the following: Committee on Research, 1948-50; Admission and Advancement, 1945-47, and as chairman, 1947-48; Federal Liaison, 1949; and Program and Papers, chairman, 1951-52.

Registered as a professional engineer in the State of Pennsylvania, Professor Queer is also a member of the *Society of Naval Architects and Marine Engineers*, United States Naval Institute, *American Society of Naval Engineers*, *ASTM*, Sigma Xi and Theta Xi. He is a member of the Cosmos Club, Washington, D.C., and is listed in *Who's Who in Engineering*.

For Treasurer—RALPH A. SHERMAN, technical director, Battelle Memorial Institute, Columbus, Ohio, has been connected with the Institute in various capacities since 1930. He has been a member of the Society for the past twenty-two years.

R. A. Sherman
Columbus, Ohio

Born in Oskaloosa, Ia. he received his bachelor's degree from the State University of Iowa in 1920. For a ten-year period he worked with the U. S. Bureau of Mines, Pittsburgh, Pa., as a fuel engineer. He was engaged in research work on combustion and heat transfer in domestic furnaces, steam power boilers and ceramic kilns. From 1922 on he was in responsible charge of these investigations for the Bureau of Mines.

Mr. Sherman joined Battelle Memorial Institute as supervisor of fuels research. In this capacity he was in charge of combustion investigations. He was promoted to assistant director in 1949 and technical director in 1953.

A member of the TAC on Solid Fuels in 1938, he became chairman in the following year. He remained as chairman when the committee became known as the TAC on Fuels in 1941 and held the position until 1945, serving as a member in 1946. Elected to the Council for a three-year term beginning in 1946, he served on the Finance Committee as member, 1947, and chairman, 1948. In 1950 he was chairman of the Special Research Plan Committee.

In addition to Society membership, Mr. Sherman is a fellow of *ASME*, and of *Institute of Fuel* (London), and a member of *ASTM*, *AGA*, *Railway Fuel and Traveling Engineers Association*, *American Society of Naval Engineers*, and Sigma Xi, and is listed in *Who's Who in Engineering*.

Mr. Sherman has written papers for the Society which have been presented at Society meetings and published in its TRANSACTIONS.

Members of Council

(three-year term)

A. B. ALGREN, professor and head, Division of Heating, Ventilating & Air Conditioning, University of Minnesota, was born in Minneapolis and graduated from the University where he now teaches with B.S. in mechanical engineering and M.S. degrees.

He has had an active career in industry, government and the teaching profession. From 1912-17 he was with the C.M. St. P. & P. Railroad. During World War I he served overseas with the AEF. He was formerly superintendent of the A. T. Rydell Sash & Door Co., in Minneapolis.

He joined the staff at the University of Minnesota in 1927 as a research engineer and has been with the school since that time except during World War II when he served as Regional Chief of Training on the War Manpower Commission. He has been successively an instructor, assistant professor, associate professor and was appointed to his present position in 1948.

Professor Algren joined the Society in 1930 and has been active in Society affairs, both locally and on Society Committees. His committee service includes the Committee on Research from 1948-53; Research Executive Committee from 1949-51; Guide Publication Committee, 1948-50, and chairman in 1950. He has also belonged to several TACs, among them: Heat Transmission, 1932-33; Heat Flow Through Glass, 1947-50; Panel Heating, Group A, 1947-50; Group D, 1947-54, and vice chairman, 1952-54; Panel Heating and Cooling Committee, 1947-55; and chairman of the TAC on Air Cleaning 1951-55.

The Minnesota Chapter had the benefit of Professor Algren's leadership as president in 1933 with service also as secretary, vice president and as a member of the board of governors.

Professor Algren as authored 12 papers which have been published in the Society JOURNAL and TRANSACTIONS. In addition, five University of Minnesota bulletins and numerous reports and articles in trade journals bear his by-line.

Professor Algren has been elected to Sigma Xi and Pi Tau Sigma, and belongs to the *ASEE*, *AAUP*, the Minneapolis Engineers Club, the *Army Ordnance Association* and the *Minnesota Association of Professional Engineers*. He is listed in *Who's Who in Engineering*, *Who's Who in America* and the *International Blue Book*.

A. B. Algren
Minneapolis, Minn.

John Everetts Jr.
Philadelphia, Pa.

J. N. Livermore
Detroit, Mich.

J. H. Ross
Toronto, Ont., Canada

JOHN EVERETTS, JR., consulting engineer with Charles S. Leopold, Philadelphia, was born in Brooklyn. His professional record

covers many responsible positions. A graduate of Brooklyn Polytechnic Institute in 1929 with an M. E. degree, he had already had six years experience with the W. L. Fleisher Co., Inc., New York, from 1923-29. During the following two years he was with Richardson and Boynton in Dover, N. J. in charge of their research laboratory. He joined the Air and Refrigeration Corp. in 1933 as secretary-treasurer.

From 1939-41 Mr. Everetts was with the Frigidaire Division of General Motors Corp., Dayton, Ohio, as a sales engineer. He served on active duty with the U.S. Navy during World War II, with the Bureau of Ships. Upon his discharge as a commander in 1946 he formed a partnership with T. H. Urdahl as Urdahl and Everetts, consulting engineers, with offices in San Francisco and Washington, D.C. He joined Charles S. Leopold in his present position in 1949.

An extremely active member of the Society, which he joined in 1929, Mr. Everetts was elected to the Committee on Research in 1951, reelected in 1954, and is currently serving as vice chairman. He is also a member of the Research Executive Committee and chairman of the Long-Range Research Program Committee. Membership on TAC's includes the following: Air Conditioning of Residences, 1934-41; Weather Design, 1938-46; Cooling Load in Summer Air Conditioning, 1938-44; Sensations of Comfort, 1949-55, vice chairman in 1955; Panel Heating and Cooling Committee, 1950-55; Sorbents, 1938-55; chairman, 1944-50, vice chairman 1952-55; Cooling Load, 1951-55; Plant and Animal Husbandry, 1953-55; and Weather Data chairman, 1954-55.

He is the author of several papers which have been presented at Society Meetings and published in the Society's TRANSACTIONS. A contributor to THE GUIDE and the *ASRE Data Book*, he has also published numerous articles appearing in trade journals.

In Society Chapters, Mr. Everetts formerly served on the board of governors of both the Golden Gate and Washington, D.C., chapters. He was vice chairman of the Committee on Arrangements for the Society's 61st Annual Meeting in Philadelphia.

Mr. Everetts is also a member of *ASRE* and the Philadelphia Engineers Club. He is a professor of mechanical engineering at Columbia University.

JAMES N. LIVERMORE, assistant director, Design Engineering Department, The Detroit Edison Co., Detroit, Mich., was graduated from Cornell University with an M.E. in 1923. He worked for a short time as a draftsman for B. F. Sturtevant Co., Hyde Park, Mass., before joining The Detroit Edison Co. in 1924. With over thirty years of work on construction engineering, Mr. Livermore has designed air conditioning systems for many large offices, and cooling and ventilating systems for power plants and electrical substations throughout the Detroit area.

A member of the Society since 1939, Mr. Livermore has been a member of the TAC on Cooling Load since 1945. He has served as a member of the TAC on Air Distribution, 1948-50 and 1954-55, and its predecessor, the TAC on Air Distribution and Air Friction, 1944-47. He was chairman of the Joint Subcommittee on Cooling Load from Glass and is a member of the Joint Subcommittee (*IES* and ASHAE) on Cooling Load from Electric Lighting.

Affiliated with the Michigan Chapter, he is now vice president and program chairman, having served as treasurer, 1953-54. He is a member of Tau Beta Pi, the Torch Club, and the *Engineering Society of Detroit*. The author of several articles on the design of air conditioning systems, his paper entitled Study of Actual *vs.* Predicted Cooling Load on an Air Conditioning System was published in the 1943 TRANSACTIONS.

JOHN H. ROSS, consulting engineer, Toronto, Ontario, Can., has been a member of the Chapter Relations Committee, 1951-52, and of the Chapters Conference Committee, 1952, serving as alternate in 1953. He is an active member of the Ontario Chapter, having held the posts of vice president, 1951; president, 1952; and member of the Board of Governors, 1950 and 1953.

After receiving his B.Sc. in mechanical engineering in 1935 from Queen's University, Kingston, Ontario, Mr. Ross gained brief experience as a draftsman and then joined the Canadian National Carbon Co., Ltd., Toronto. He went to Buenos Aires, Argentina, in 1937 to work on the design and operation of a new factory for National Carbon's foreign department. In the years following, he was employed in design, installation, and maintenance for various arms and munitions plants. Previous to starting private practice as a consulting engineer in 1945, Mr. Ross had been engaged as works engineer for John Inglis Co., Ltd. and Small Arms, Ltd., Long Branch, Ontario; project engineer for Defense Industries, Ltd., Montreal; and mechanical engineer for G. Lorne Wiggs & Co., Montreal, Quebec.

Mr. Ross holds membership in *AIEE*, *Association of Professional Engineers of Ontario* and the *Engineering Institute of Canada* and is listed in *Who's Who in Engineering*. He has been a member of the Society since 1946.

Committee on Research

(three-year term)

FRANK H. FAUST, manager, Product Planning and Marketing Research Service, Air Conditioning Division, General Electric Co., Bloomfield, N. J., was born in Salt Lake City, Utah. He attended Sheffield Scientific School, Yale University, from which he received his B.S. in 1926. Mr. Faust also took a course in industrial physiology at the Harvard University School of Medicine, and a course in air conditioning at Case Institute of Technology. During his association with General Electric, he took the company's advanced engineering course and courses in heating, air conditioning, sales analysis, and better business management.

Formerly an assistant instructor at Yale, Mr. Faust joined the General Electric Co. in 1926, and has been successively in the Testing Department, the Domestic and the Commercial Refrigerator Engineering Divisions, the Engineering General Department, the Air-Conditioning Department, and the Commercial Engineering Division.

Mr. Faust is a contributor to the Society's HEATING, VENTILATING, AIR CONDITIONING GUIDE, is associate editor, Section VIII of the Applications Volume, *ASRE Data Book*, and was editor-in-chief of the 1951 edition of the *Handbook of Oil Burning*.

Mr. Faust joined the Society in 1930 and was a member of the Joint Committee for Rating Commercial Refrigerating Equipment, a joint committee with *ASRE*, and is currently a member of the Joint Committee on Standards for Comfort Air Conditioning, a joint committee with *ASRE* and *ASME*.

He has served on numerous Society committees, the Chapters Conference 1953-54, a three-year term on the Committee on Research 1953-55, during which term he served as a member of its Executive and Long-Range Research Program Committees, as well as vice chairman of its TAC on the Heat Pump. He is currently serving a three-year term on the Society's Standards Committee, and is chairman of the Society's Special ASHAE-*ASRE* Joint Committee on Cooperation.

Active in the organization of the North Jersey Chapter, organized in 1952, Mr. Faust served as its president in 1953-54 and as a member of its board of governors 1953-55.

Mr. Faust, a member of the New York Chapter, was general chairman of the Committee on Arrangements for the 1952 Semi-Annual Meeting in Spring Lake, N. J.

He is also a Council member of the *American Society of Refrigerating Engineers*, and a member of the *National Fire*

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Protection Association, serving as chairman of its Committee on Air Conditioning, and Tau Beta Pi, the honorary engineering fraternity. Mr. Faust is vice chairman of the Code Drafting Committee and is a member of the B-9 Code for Mechanical Refrigeration Committee of the *American Standards Association*.

F. H. Faust
Bloomfield, N.J.

FORD K. HICK, M.D., professor of medicine, University of Illinois, Chicago, divides his time between the practice of internal medicine and teaching. He is the co-author of numerous technical papers, some of which have been published in several issues of the TRANSACTIONS.

Dr. Hick received his education at the University of Illinois, acquiring the following degrees: M.D., 1930; M.S. (pathology), 1933; and Ph.D. (medicine), 1936. Following his internship at Cook County Hospital, he remained there as assistant resident in pathology. He is a diplomate of the American Board of Internal Medicine, 1938, and for the sub-specialty of cardiovascular diseases, 1953.

F. K. Hick, M.D.
Chicago, Ill.

Beginning as an instructor at the University of Illinois in 1932, he became associate (1936), assistant professor (1937), associate professor (1945), and professor of medicine since 1950. From 1945-46 he served full time as assistant dean in charge of postgraduate instruction.

Although he joined the Society in 1951, Dr. Hick had been a member of the TAC on Physiological Research since 1949. He is vice chairman of that committee and of the TAC on Sensations of Comfort this year. Last year he was appointed to fill an unexpired two-year term on the Committee on Research.

Dr. Hick is a member of the *Chicago Medical Association, Illinois State Medical Association, American Medical Association, American Heart Association*, and *Chicago Diabetes Association*. He is president of the *Chicago Society of Internal Medicine*, was secretary of the *Central Society for Clinical Research* from 1946-48, and is a fellow of the *American College of Physicians*.

RICHARD C. JORDAN, professor and head, department of mechanical engineering, University of Minnesota, Minneapolis, has spent his educational and professional career largely in connection with the University. He was awarded a Ph.D. from the University of Minnesota in 1940, having previously received a bachelor's degree in aero engineering, 1931, and M.S. in mechanical engineering, 1933.

R. C. Jordan
Minneapolis, Minn.

Following a few years in charge of the Minneapolis branch of American Radiator and Standard Sanitary Corp. and a year as instructor in petroleum engineering at the University of Tulsa, Tulsa, Okla., he returned to the University of Minnesota in 1937 as an instructor with the Engineering Experiment Station. He successively became assistant director of the Engineering Experiment Station and assistant professor, and then associate professor. In 1944 he assumed the directorship of the Industrial Laboratory. He was named a full professor in 1946, serving as head of the department since 1951.

Arthur Nutting
Louisville, Ky.

Professor Jordan has written extensively for technical engineering journals on refrigeration, heating, ventilating, air conditioning, dust control, mechanical engineering, and education. He is the co-author of three volumes: *Refrigeration and Air Conditioning, Aids to Technical Writing* and *Air Conditioning*. Since 1946, he has been on the board of abstractors for *Refrigeration Abstracts*.

A member of the Society since 1933, Professor Jordan has been a member of the TAC on Heat Pump since its inception in 1948, serving as chairman during the first four years. He was a member of the TAC on Instruments, 1944-45, and has been a member of the TAC on Evaporative Cooling since 1953, and Cooling Load since 1947, serving as vice chairman last year. He was elected vice president of the Minnesota Chapter in 1948, became president in 1949, and served as a member of the board of governors in 1950.

H. A. Lockhart
Morton Grove, Ill.

A fellow of *ASRE* and a member of their Council since 1944, he has held various posts in that Society, culminating in the presidency in 1953. He also holds membership in *ASEE, ASME, American Ordnance Association, AAAS, AAUP*, Minneapolis Engineers Club, *Minnesota Federation of Engineering Societies, Minnesota Society of Professional Engineers, National Society of Professional Engineers* and *Institut International du Froid*, as well as Tau Beta Pi, Sigma Xi and Pi Tau Sigma. He is a registered professional engineer in the state of Minnesota and is listed in *Who's Who in Engineering*.

The Outstanding Publications Award was bestowed upon Professor Jordan by *ASRE* in 1949. Last year he became a member of the division of engineering and industrial research of the National Research Council and consultant on the Advisory Panel for Engineering Societies, National Science Foundation. At the Ninth International Refrigeration Congress held in Paris this September, he represented the National Research Council; *ASRE*, as delegate; and the Engineers Council for Professional Development, as honorary vice president.

HAROLD A. LOCKHART, vice president and chief engineer, Bell & Gossett Co., Morton Grove, Ill., was born at Nashville,

Tenn. Brought up in St. Paul and Minneapolis, he obtained a Bachelor of Mechanical Engineering degree from the University of Minnesota in 1929.

After graduation, he worked as a research engineer for the Insulite Co., Minneapolis, doing work on insulation board. He later worked with Stott Stoker Co., St. Paul, as design engineer and production manager.

For the past twenty-one years, he has been chief engineer at Bell & Gossett Co. where he has been in complete charge of the engineering department and has been a part of the rapid development and growth in the hot water heating industry. His promotion to vice president was announced last year.

Mr. Lockhart has served two three-year terms on the Committee on Research and is presently a member of its Executive Committee and Long-Range Research Program. He has worked on several TACs as follows: Fluid Flow in Pipes, 1941-42; Panel Heating and Cooling, Group B, 1948-55; Hot Water and Steam Heating, as member, 1950-51, and vice chairman, 1952-55; Sound and Vibration Control, chairman, 1952-55; Heating Load, 1953; and Plant and Animal Husbandry, as member in 1953 and vice chairman since last year.

He is a licensed engineer in the State of Illinois and also belongs to the *American Society of Mechanical Engineers*, and Theta Tau and Pi Tau Sigma fraternities.

ARTHUR NUTTING, vice president and chief engineer, American Air Filter Co., Inc., Louisville, Ky., has been associated with that company or its predecessor, Reed Air Filter Co., since 1927.

Mr. Nutting was born in Louisville, and attended the University of Kentucky, with three years of study in mechanical engineering and two years in civil engineering. He received his B.S. in civil engineering in 1926. Previous to graduation he worked on design and heating layouts for two architectural firms in Lexington, Ky., Frankel & Curtis Co. and Churchill & Gilleg Co. He also was employed briefly by H. K. Bell, sanitary engineer in Lexington.

It was in January 1927 that he became associated with Reed Air Filter Co., Louisville, beginning many years of specialization in research and design of air filtering and dust collecting equipment. Ten years later, he was named chief engineer, American Air Filter Co., in charge of engineering and research programs. His appointment as vice president in charge of engineering was announced in 1947.

Since 1949 Mr. Nutting has been a member of the Society's TAC on Air Cleaning. His paper, An Alternate Method of Comparing the Dust Arrestance of Air Cleaning Devices, was published in the 1937 volume of the TRANSACTIONS. At present, Mr. Nutting is secretary-treasurer of the Air Filter Institute. A golf devotee, he won the Falls Cities Amateur Golf Championship (Metropolitan Louisville) in 1951, and was a member of the winning Harding Cup golf team, USGA, in the 1937 Public Links Championship.

PARMELEE LEAVES LABORATORY

The resignation of G. V. Parmelee, senior research supervisor at the ASHAE Research Laboratory, effective September 30 has been accepted by the Committee on Research according to an announcement by Pres. J. E. Haines.

Mr. Parmelee, who has been a member of the Research staff since 1945 and the

G. V. Parmelee

author of many ASHAE technical papers, has taken a position with the Arabian-American Oil Co. and will be stationed in Dhahran, Saudi-Arabia. He will be assigned to the general engineering organization as a staff engineer specializing in air conditioning and refrigeration.

He is leaving this month for Beirut, Lebanon, where he will stay for an orientation period, before proceeding to Dhahran. Mr. Parmelee's wife and two daughters are already in Beirut and will remain there until it is possible for them to join him in Dhahran, which is approximately 1000 miles from Beirut.

NEW TECHNICAL ADVISORY COMMITTEES APPOINTED

Three new Technical Advisory Committees have been organized. Two will guide Society research in Solar Energy Utilization and Thermal Circuits. The third is responsible for research on Infiltration.

In 1950 a cooperative project was undertaken at the University of Minnesota

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under the advisory guidance of the TAC on the Heat Pump to study solar energy as a heat source for the heat pump. In these studies, a serious lack of engineering data on solar collectors was noted. To correct this, a cooperative project on solar collectors was initiated. The new TAC provides guidance for this and other projects which may be undertaken on solar utilization. The membership of the new TAC on Solar Energy Utilization is particularly interesting because of its distinct international flavor. Outstanding authorities in this field from several distant countries have accepted membership on the Committee.

Air-conditioning engineers are continually searching for methods of improving their heating and cooling load calculations as the assumption of steady-state conditions is unsatisfactory. In 1952 Dr. Nottage proposed the thermal-circuit technique. The TAC on Cooling Load has guided work in this field at the Society Laboratory and at the University of California. The TA Committees on Heating Load, Heat Flow Through Glass, Insulation, and the Heat Pump also recognized the thermal-circuit technique as a tool that could be applied to some of their problems. To avoid duplication of effort, the new TAC on the Thermal Circuits was organized.

In 1953, under a cooperative research project with the University of Illinois, a study of infiltration was undertaken, using a tracer-gas technique developed in England and checked for ASHAE by the U. S. Bureau of Standards. This work is still in progress. Since infiltration is of interest to both the TAC on Cooling Load and the TAC on Heating Load, it seemed desirable to appoint a new TAC on Infiltration to guide research which would develop data applicable to both heating and cooling conditions.

Names of the members of these three new Committees appear on page 167 of this issue.

John R. Allen Memorial Library

The ASHAE Committee on Research gratefully acknowledges the following gift to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

Proceedings of the National District Heating Association,
Vol. 44, 1953. Gift of the Association.

The presentation of textbooks and pamphlets in the field of heating, ventilating and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

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Summary of Chapter Meetings

• *MEMPHIS:* W. L. Henson, program chairman, introduced F. H. Kellogg, dean of the Engineering School, University of Mississippi, University, Mississippi, who spoke at the May meeting on *Plant Sites in the Memphis Area.* Among other plant sites mentioned, Dr. Kellogg spoke on the Dixon-Yates site and the reasons for its selection. He also discussed starting salary rates of college graduates, observing that starting salaries are not as high as current publicity indicates.

Following Dr. Kellogg's talk, approval was given to a motion that the Chapter furnish a GUIDE and a subscription to *Heating, Piping & Air Conditioning* for the Engineering Library at the University of Mississippi. Under new business, Pres. John Hilton, II, appointed picnic and telephone committees, under the chairmanship of W. L. Henson, and a membership committee, with J. P. Manis as chairman.

•*MISSISSIPPI: Refrigerant Piping* was the subject of the August guest speaker, G. V. Bond, Carrier Corp., Syracuse, N.Y. Mr. Bond, who was introduced by F. H. North, presented an interesting and informative program.

Pres. J. E. Davis, Jr., announced that it had been decided at a board of governors meeting to accept an invitation to participate in a program with the Mid-Southern Section, *ASCE.* Burt Lomax, Jr., was appointed to represent the Mississippi Chapter in the proposed program.

•*MISSISSIPPI:* In the absence of the president, the July meeting was presided over by the treasurer, J. W. Doggett, Jr., who read the treasurer's report.

B. L. Palmer introduced the speaker, E. T. Thomas, attorney, with the firm of Wells, Thomas & Wells, Jackson, Miss. The title of Mr. Thomas' talk was *The Legal Problems of Contracting.*

•*NORTH TEXAS:* A. P. Flannes, member of the program committee, introduced the guest speaker at the August meeting, K. P. Chamberlain, Tube Turns, a division of National Cylinder Gas Co., Louisville, Ky. In a thoroughly interesting presentation, Mr. Chamberlain described the chemical and commercial background of polyvinylchloride, beginning with its introduction to this country from Germany in 1948. During a spirited question and answer session following the talk, the advantages, limitations and future applications of polyvinylchloride were explored with special emphasis on how these might affect the heating and ventilating profession.

Pres. J. A. Ray presided at the meeting and introduced the new chapter members.

NOISE STUDY AT LABORATORY

A new study of noise from air equipment and installations under the TAC on Sound and Vibration Control was approved by the Committee on Research at its meeting on August 25 at the ASHAE Research Laboratory, it has been announced by B. H. Jennings, chairman.

This program has been acknowledged by the *National Association of Fan Manufacturers,* according to E. R. Kaiser, director of research, and they will cooperate by bringing it to the attention of their members.

The project is described as an effort to develop a basic method of sound measurement which can be adopted as a standard so that noise control can be organized on an engineering basis.

The TAC, under the chairmanship of H. A. Lockhart, Morton Grove, Ill., has assembled and screened numerous technical suggestions. In addition to the measuring technique sought it will also seek to determine the attenuation of sound in ducts and the regeneration of noise by turbulence in duct fittings and dampers.

This project will be conducted at the Research Laboratory in Cleveland and it is planned to get the program under way this Fall.

ASHAE Committee on Research meeting at the Research Laboratory, Cleveland, August 25, 1955. *l. to r. (Seated)* E. F. Snyder, Jr., F. H. Faust, R. S. Dill, H. A. Lockhart, R. C. Chewning, B. H. Jennings, chairman; Miss Ilse M. Jahn, secretary; N. B. Hutcheon, H. R. Limbacher, J. W. McElgin, W. S. Harris, John Everetts, Jr., vice chairman; E. R. Kaiser, director of research. *(Standing)* C. M. Humphreys, assistant director of research; R. A. Miller, F. K. Hick, M.D., W. F. Friend, A. V. Hutchinson.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 43 applications, for membership, including 6 reinstatements; in addition 41 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by September 30, 1955, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Arkansas

△COOK, G. M., Mech. Engr., Blaylock & Assocs., Inc., Little Rock. REFERENCES: R. E. Blaylock, W. J. Franklin, E. N. Pettit, T. W. Turner.

California

△ARONOVSKY, G. N., Mech. Engr., International Sales Co., San Francisco. REFERENCES: J. F. Deane, E. C. Fanning, C. E. Larson, R. G. Tuck.

GORSEY, L. M., Sales Engr. Utility Fan Corp., Los Angeles. REFERENCES: Leo Hungerford, Richard Peterson*, Henry Sachs*, V. C. Smith*.

LEE, C. H., Engr., Buonaccorsi, Murray & Lewis, San Francisco. REFERENCES: A. L. Buonaccorsi, J. E. Murray, J. A. Smith*, H. A. Wolfson.

MCBRIDE, I. C., Air Cond. Engr., Southern California Gas Co., Los Angeles. REFERENCES: R. H. Phillips, L. B. Rayl, M. D. Shafer, I. D. Shea.

MCELLIGOTT, R. W., Estimator, Slakey Bros., Inc., Sacramento. REFERENCES: J. E. Day, John Lillie*, R. L. Slakey*, R. E. Stockwell*.

MEGNA, V. A., Mech. Engr., Daniel, Mann, Johnson, Mendenhall, Archts. & Engrs., Los Angeles. REFERENCES: R. J. Beaubien, F. M. Neal, R. C. Taylor, Albert Zimmerman.

RASMUSSEN, W. E., Asst. Sales Mgr., University Heating & Air Conditioning Co., San Diego. REFERENCES: S. W. Brewer*, R. L. Huntington, F. C. Kirschner*, W. F. Leiber*.

Colorado

△WARSHAUER, K. R., JR., Mgr., Air Engineering, Inc., Denver. REFERENCES: J. B. Berger, J. F. Cipra, D. D. Pearsall, H. L. Wray.

District of Columbia

△WAGNER, V. O., JR., Mech. Engr., Bureau of Ships, Navy Dept., Washington. REFERENCES: C. C. Carson, A. E. De Somma*, J. W. Ford*, A. F. Phillips, Jr.

Florida

SHELTON, STEPHEN, Chief Engr., Biscayne Air Conditioning Co., Miami. REFERENCES: D. E. Britt*, Mike Deutschman*, J. E. Mitchell*, W. E. Wall.

Georgia

△DAUGHERTY, C. F., JR., Chief Engr., Carrier Atlanta Corp., Atlanta. REFERENCES: L. L. Barnes, J. W. Borum, J. G. Croley, S. N. Roberts.

KLEIN, R. D., Repr., E. W. Klein & Co., Atlanta. REFERENCES: J. W. Austin, Jr., C. B. Cole, E. W. Klein, Jr., D. M. McRae.

△MARSHALL, J. A., Reg'l. Com. Sales Mgr., Minneapolis-Honeywell Regulator Co., Atlanta. REFERENCES: F. W. Bull, J. E. Haines, L. F. Lawrence, Jr., J. M. Lazenby.

Illinois

△ANDERSON, G. E., Refrig. Engr., *Association of American Railroads*, Chicago. REFERENCES: R. C. Jordan, M. W. Keyes, C. E. Lund, F. B. Rowley.

△FAKTER, MELVIN, Vice-Pres., Reliable Sheet Metal Works, Inc., Chicago. REFERENCES: E. H. Gage, R. S. Geocaris, R. W. Lawinger, L. O. Paul.

△KAISER, J. H., Pres., H. S. Kaiser Co., Chicago. REFERENCES: Gideon Goldschmidt, H. S. Kaiser*, I. S. Kaiser, Herbert Kreisman.

△SEWELL, D. K., Mgr., Research & Devlpt. Lab., Herman Nelson Div., American Air Filter Co., Inc., Moline. REFERENCES: A. B. Algren, A. W. Anderson*, H. M. Fitch, A. F. Hubbard.

△WHITE, W. A., Appl. Engr., Murphy-Miller, Inc., Chicago. REFERENCES: E. B. Boston, H. G. Chapin, G. G. Freyder, G. V. Zintel.

Indiana

△DWYER, WILLIAM, JR., Mfrs. Repr., Indianapolis. REFERENCES: I. W. Cotton, T. R. Davis, E. G. Fowler, George Heidenreich.

△WESNER, EUGENE L., Engr., U. S. Rubber Co., Indianapolis. REFERENCES: F. C. Barton, Sidney Fenstermaker, Jr., Alfred Pfau, G. W. Vogel.

Iowa

OLSON, J. P., Engr., V. J. Hagan Co., Sioux City. REFERENCES: R. D. Anderson, H. A. Barnard, R. M. Berry, Verne Simmonds.

△PULLEY, F. L., Cons. Engr., Des Moines. REFERENCES: D. C. Murphy, W. E. Nanes, R. H. Schnell, D. E. Wells.

Louisiana

BEAULLIEU, F. D., III, Engr., Beaullieu Air Conditioning and Heating Co., Lafayette. REFERENCES: D. W. Chesson, A. W. Holland, R. E. Jenkins, W. I. Pol.

CHESSON, D. W., Partner, Chesson, Forrest & Holland, Cons. Engrs., Baton Rouge. REFERENCES: A. W. Holland, C. W. Lane, A. J. Mayers, Jr., W. I. Pol.

△ELSTROTT, J. B., Assoc., Walter Cooke, New Orleans. REFERENCES: G. S. Cox, W. J. Leblanc, W. I. Pol, C. S. Woodruff.

FLANNER, L. T., SR., Chief Chemist, General Chemical Div., Allied Chemical & Dye Corp., Baton Rouge. REFERENCES: J. E. Byers, W. I. Pol, F. W. Stone, R. P. Thibodeaux.

△GREEN, W. M., Bldg. Maint. Supvsr., Southern Bell Telephone and Telegraph Co., New Orleans. REFERENCES: C. B. Castiglione, C. B. Gamble, C. W. Lane, W. B. Martin, Jr.

JENKINS, R. E., Assoc. Prof., Mech. Engrg., Southwestern Louisiana Institute, Lafayette. REFERENCES: F. D. Beaullieu, III, D. W. Chesson, A. W. Holland, W. I. Pol.

TERITO, S. J., Owner, Samdot Insulations, Baton Rouge. REFERENCES: Larry Calahan*, G. M. Guynn, W. I. Pol, Sam Vince.

Maryland

KAHLERT, W. E., Production Mgr., Baltimore Aircoil Co., Baltimore. REFERENCES: A. B. Algren, John Engalitcheff, Jr., R. R. Forseille, R. W. Pentecost.

Massachusetts

DE SOUSA, R. J., Sr. Draftsman, Metcalf & Eddy, Boston. REFERENCES: D. W.

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Blair, Morris Brown, R. C. Carter, P. H. White.

JAMISON, G. C., Indus. Consultant, Western Massachusetts Electric Co., Springfield. REFERENCES: J. G. McKearin*, D. C. Scott, J. M. Turnbull*, W. H. Weaver*.

†JONES, H. S., Partner Kimball-Jones Co., Boston. REFERENCES: W. E. Barnes, C. A. Biancucci, C. W. Larson, E. G. Lund.

†KINGSBURY, N. E., Asst. Engr., Metcalf & Eddy, Boston. REFERENCES: Morris Brown, W. J. Bush*, D. M. Collins, P. H. White.

LYNCH, W. F., Sales Engr., Westinghouse Electric Corp., Sturtevant Div., Boston. REFERENCES: D. W. Blair, G. D. Fife, R. V. Norman, F. P. Williams.

Michigan

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Oklahoma

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Hong Kong

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Journal Section

Venezuela

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Encyclopedia on Instrumentation

It has been announced by the Institute of Industrial Health and School of Public Health of the University of Michigan that a new Encyclopedia on Instrumentation for Industrial Hygiene is in course of preparation.

It is being assembled and edited by a staff of experts assigned by the U. S. Public Health Service.

The book will contain 29 comprehensive review and special technical papers presented to the Symposium on Instrumentation for Industrial Hygiene held May 24-27, 1954. There is to be a comprehensive review of instrumentation, the 29 technical papers, and a description of the instruments including some 671 commercially produced and 87 home-assembled instruments.

The book is planned to consist of approximately 1200 pages with over 1400 illustrations, cross-indexed, involving 6000 items and bound in heavy hard covers.

A special pre-publication discount price for those interested has been set at $15.50 per copy.

ASME to Meet in Chicago

The *ASME* diamond jubilee Annual Meeting is to be held in Chicago from November 13-18. More than 300 technical papers and 110 sessions are programmed.

The Chicago Section has arranged an interesting and diversified program of events including a dinner and pageant highlighting *ASME* milestones from 1880 to the present. At a special honors luncheon five major joint engineering awards will be conferred.

The diamond jubilee banquet will highlight the week-long festivities.

Sidelighting the 75th anniversary celebration will be the Exposition of Power and Mechanical Engineering at the Chicago Coliseum from November 14-18. A new section on atomic power will be featured.

OBITUARIES

GEORGE W. HUBBARD
Chicago, Ill.

George Wallace Hubbard, consulting engineer, who was honored by Life Membership in the Society in 1941, died on July 21, 1955 at the age of 78.

Born in Urbana, Ill., on December 15, 1876, Mr. Hubbard attended Urbana public and high schools and received a B.S. from the University of Illinois in 1899. He gained drafting experience at Murphy Iron Works, Detroit, Mich., before joining Burnham & Co., Chicago, in 1902. He advanced to assistant mechanical engineer in this connection. Later, he became associated with Graham, Anderson, Probst & White, Chicago architects, remaining with them as chief mechanical engineer until 1938. From that time on he acted as a consulting engineer.

Mr. Hubbard joined the Society in 1911. His paper on the Heating and Ventilating Systems at the U. S. Government's Smokeless Powder Plant at Nitro, West Va. was published in the 1919 TRANSACTIONS.

ARTHUR L. PHILASTRE
Kinston, N.C.

Arthur L. Philastre, 50, who was engaged in the sheet metal industry for about 30 years, died on July 8, 1955. In recent years, Mr. Philastre was connected with the Construction Division, E. I. du Pont de Nemours & Co., Kinston, N. C., as a sheet metal draftsman.

Mr. Philastre was born in New Orleans, La., on August 30, 1904. Over a fifteen-year period from 1935-50, he was employed as a designer and draftsman for Superior Heating and Ventilation Co., New Orleans; Wallace Plumbing & Dallas Air-Conditioning Co.; Crescent City Sheet Metal Works, New Orleans; Arnold Engineering & Construction

Co., Atlanta; and Gibbs Enterprises General Engineering Co., Miami. From 1939-40 he acted as an instructor for the Southwest Louisiana Trade School. Previous to joining du Pont de Nemours, he had opened his own company, A. L. Philastre, Inc., serving as president. He joined the Society in 1950.

Surviving is his widow who resides in Hapeville, Ga.

PHILIP R. PULLEN
Rapid City, S. D.

Word has been received of the recent untimely death of Philip R. Pullen, at the age of 32. Mr. Pullen was a mechanical engineer for Dealers Supply Co., Rapid City, S.D.

Born in Lead, S.D. on May 18, 1922, he received his B.M.E. from Cornell University in 1948. He joined the Dealers Supply Co. after graduation, beginning in sales and service. Mr. Pullen became a member of the Society in 1951. He also belonged to *ASME* and *AOA*.

ALF TJERSLAND
Oslo, Norway

A Life Member of the Society, Alf Tjersland, Oslo, Norway, died on June 12, 1955. Mr. Tjersland, 73 years old at the time of his death, was president and managing director of A/S E. Sunde & Co., Ltd.

Well known in Oslo, Mr. Tjersland was a central figure in various technical and commercial organizations. He was a member of the *Swedish Society of Heating and Sanitary Technique* and had served as president of Norway's League of Home Industrial, as well as chairman of various societies.

Born at Christiania, Norway, on September 6, 1881, he received his M.E. from the Institute of Technologie at Mittweida Saxony in 1903. The following year he studied at The Royal Technical College in Glasgow, Scotland. His practical experience was gained in Norway, Scotland and the United States.

Mr. Tjersland's first connection with E. Sunde & Co. was during the first few years after his graduation from high school in 1896, and again for a year after the receipt of his master's degree. He had already

Alf Tjersland
Oslo, Norway

gained experience in steamfitting, drafting and estimating when he was employed in Glasgow as a steamfitter's helper from 1904-1905. Moving to the United States, he further broadened his experience in brief connections with Platt Iron Works, Dayton, Ohio, and Davis Construction Co., Chicago, Ill. He returned to Norway and E. Sunde & Co. in 1907, becoming administrative director in 1914 and director in 1922.

A member of the Society since 1906, Mr. Tjersland displayed keen interest in its affairs. He particularly enjoyed his visit to the United States in 1919 for the 25th anniversary of the Society. Many institutions, including the ASHAE Research Laboratory, benefited from his generosity.

RICHARD Y. C. TOM
Honolulu, Hawaii

The Society has received word of the untimely death of one of its Junior Members, R. Y. C. Tom. He joined the Society as a student member early in 1954 and advanced to Junior grade later in the year.

Mr. Tom was born in Honolulu, Hawaii, on August 7, 1928. He was a graduate of the University of Hawaii with a B. A. in mathematics in 1951. In May 1954 he received a B. S. in mechanical engineering from Purdue University. Following graduation, he was employed by Gardner Machine Co., Beloit, Wisc.

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Journal Section

ASHAE — OFFICERS OF CHAPTERS AND BRANCHES

(60 Chapters; 1 Special Branch; 8 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARIZONA:** 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES., W. A. Biddle, 3817 N. 15th Ave. SECY., E. P. Maxwell, 39 W. Adams St.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, 3rd Tues. PRES., W. L. Franklin, 608 W. Third St. SECY., J. W. Thompson, 1314 Main St.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, 2nd Mon. PRES., T. A. Barrow, Jr., 302 Ponce de Leon Ave., N.E. (8). SECY., J. A. Marshall, 1415 Howell Mill Rd., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, 3rd Wed. PRES., E. J. Morris, 813 N. Calvert St. (2). SECY., E. J. Dull, 1122 N. Charles St. (1).

● **BATON ROUGE:** 1955. Hdqrs., Baton Rouge, La. Meets, 3rd Wed. PRES., C. S. Woodruff, P.O. Box 358. SECY., A. J. Mayers, Jr., 7732 Goodwood Ave.

● **BLUEGRASS:** 1954. Hdqrs., Louisville, Ky. Meets, 2nd Mon. PRES., W. M. Pace, 1817 S. Third St. (8). SECY., R. B. Duggan, 41 Beachwood Rd., Jeffersonville, Ind.

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. Meets, 2nd Wed. PRES., Cornelius Van Booyen, 636 Drake St. (3). SECY., A. C. Martin, 425 W. Second Ave.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, 4th Wed. PRES., F. D. Putnam, 115 Pulsifer Dr., Auburn. SECY., Merle Weninger, 230 Goodrich Ave. (5).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, 3rd Mon. PRES., R. A. Wilson, 2240 N. High St. SECY., T. R. Walker, 182 N. Yale Ave.

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets 1st Tues. PRES., A. H. Gerdsen, 224 E. Second St. (2). SECY., T. D. Reiley, 1905 Dunlap St. (14).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, 3rd Thurs. PRES., E. J. Hoagland, 257 Whitney St., Hartford. SECY., J. D. Pierce, 775 Capitol Ave., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, 3rd Tues. PRES., W. B. Martin, Jr., 635 Commercial Pl. (12). SECY., R. K. Goode, 3613 Pine St. (25).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, 2nd Wed. PRES., L. V. Appleby, N. Pearl & Van Woert Sts. (4). SECY., E. J. Mahoney, 45 Colvin Ave.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, 1st Thurs. PRES., D. E. McLeod, 2415 Green St. (23). SECY., Herb Duncan, 938 N. Linden Ave., South San Francisco.

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, 2nd Mon. PRES., G. G. Freyder, 72 W. Adams St. (90). SECY., Herbert Kreisman, 117 N. Desplaines St. (6).

● **INDIANA:** 1943. Hdqrs. Indianapolis, Ind. Meets, 4th Tues. PRES., J. W. Jackson, 1531 N. Pennsylvania St. (2). SECY., G. W. Vogel, 31 E. Georgia St. (4).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, 1st Mon. PRES., F. W. Jenkinson, 228 Hutton Bldg. SECY., J. A. Doyle, W. 3018 Broad.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, 2nd Tues. PRES., G. J. Kraai, 907 Sixth Ave. (14). SECY., W. A. Schworm, Physical Plant Dept., Iowa State College, Ames.

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tues. after 1st Mon. PRES., Charles Yoe, P.O. Box 2239. SECY., T. L. Roberts, 2008 S. Parkwood Lane.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, 1st Mon. PRES., A. S. Hurt, Jr., 2119 Washington St. (8). SECY., S. C. McCann, 210 W. Tenth St. (5).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, 4th Thurs. PRES., G. C. Davis, 212 Waverly St. (9). SECY., A. H. Millar, 342 Mandeville St., St. James (12).

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, 3rd Tues. PRES., G. D. Fife, 79 Milk St. SECY., R. F. Curry, 80 Ripley St., Newton Centre (59).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, 3rd Mon. PRES., John Hilton II, 4443 Sequoia. SECY., L. V. Eberle, Jr., 1358 Clementina.

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, 1st Wed. PRES., D. E. Tullis, 1720 Parkhill Drive (6). SECY., L. P. Brehm, Jr., 111 S. Broomfield Rd.

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, 1st Mon. after 10th of month. PRES., D. S. Falk, 4864 Woodward Ave. (1). SECY., J. H. Spitzley, 1200 W. Fort St. (26).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, 1st Mon. PRES., J. S. Locke, 2753 Fourth Ave., S. (8). SECY., F. G. Vogt, 6530 W. Lake St. (16).

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. Meets, 4th Mon. PRES., J. E. Davis, Jr., P.O. Box 3216, West Jackson (7). SECY., L. H. Smith, 711 W. Capitol St.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, 3rd Mon. PRES., R. J. Ker, 5000 Namur St. (9). SECY., W. E. Jarvis, P.O. Box 61.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, 2nd Tues. PRES., T. E. Davis, 4303 Dodge St. SECY., C. A. Failer, 1802 Mason St. (2).

● **NEW MEXICO:** 1954. Hdqrs., Albuquerque, N. M. Meets, 3rd Mon. PRES., H. F. Munn, 419 Granite, N.W. SECY., J. K. James, 4462 Avenida del Sol.

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, 3rd Mon. PRES., Albert Giannini, 365 Madison Ave. (17). SECY., Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, 2nd Tues. PRES., C. H. Smith, 2300 N. Stiles St., Linden. SECY., M. C. Christesen, 196 Everett Pl., Englewood.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, 3rd Mon. PRES., J. A. Ray, 4411 Belmont Ave. (4). SECY., G. H. Meffert, 3328 Greenbrier Dr. (5).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, 2nd Tues. PRES., J. T. McKinney, P.O. Box 5145 (18). SECY., G. A. McCune, 1908 Utica Square.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, 2nd Mon. PRES., L. C. Burkes, 1792 E. 40th St. SECY., R. A. Urban, Sr., 1740 E. 12th St. (14).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N. C. Meets, 2nd or 3rd Fri. PRES., S. T. Oliver, 2307 Fairfield Ave. SECY., E. D. Frazier, 320 Ashland Dr.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, 2nd Mon. PRES., J. R. Patten, 1726 N.W. Fifth (6). SECY., A. C. Shelley, 2946 Nimitz (12).

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, 1st Mon. PRES., M. C. Bailey, 1139 Bay St. SECY., H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thurs. after 1st Tues. PRES., Dick Blankenship, Cascade Bldg. (4). SECY., W. B. Hayes, 707 Portland Trust Bldg. (4).

● **OTTAWA VALLEY:** 1952. Hdqrs. Ottawa, Ont., Canada. Meets, 3rd Tues. PRES., E. J. Schownherr, 32 Clarey Ave. (1). SECY., D. W. Banton, 380 Richmond Rd. (3).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, 2nd Tues. PRES., P. I. L. Winsor, 20031 Marine View Dr., S.W. (66). SECY., M. W. McKinstry, 4017 McGilvra St. (2).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, 2nd Thurs. PRES., A. M. Robertson, 1200 Locust St. (7). SECY., R. J. Sigel, 822 Montgomery Ave., Narberth.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, 3rd Mon. PRES., C. L. Benn, 420 Blvd. of Allies (19). SECY., E. H. Riesmeyer, Jr., 231-33 Fort Pitt Blvd. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, 1st Wed. PRES., L. L. DeLong, 2027 S. Washington St. (10). SECY., W. V. Burbank, P.O. Box 840.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, 1st Wed. PRES., R. A. Sarro, 5412 Argo Way (21). SECY., M. J. Delavan, 405 Meister Way (19).

● **ST LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, 2nd Tues. PRES., E. T. Clucas, 4354 Olive St. SECY., N. J. Hubbuch, Jr., 7020 Cornell, University City (5).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, 3rd Thurs. PRES., R. S. Segall, 848 River Rd. SECY., A. L. Jones, Jr., 753 Gladstone.

● **SOUTH CAROLINA:** 1954. Hdqrs., Columbia, S. C. PRES., H. K. Rouse, P.O. Box 3731, Greenville. SECY., B. A. Leppard, P.O. Box 3294, Station "A," Greenville.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, 3rd Fri. PRES., F. M. Neil, P.O. Box 13197 (19). SECY., A. B. Ullrich, 2520 Huldy St. (19).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, 1st Tues. PRES., J. L. McCullough, 1978 S. Los Angeles St. (11). SECY., W. J. Biggar, 6620 Telegraph Rd. (22).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRES., L. F. Lawrence, Jr., 212 Greystone Rd. SECY., G. C. Garrett, P.O. Box 3697.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, 3rd Tues. PRES., F. B. Frazee, 1013 Riverside Dr., Austin (4). SECY., J. L. Rea, Jr., 300 West 8th St., Austin.

● **TOLEDO:** 1954. Hdqrs., Toledo, Ohio. PRES., C. F. Hoffman, 523 Spitzer Bldg. (4). SECY., R. I. Fruth, 1316 Adams St. (2).

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, 3rd Thurs. PRES., R. C. Evans, 2549 Wilmington Ave. (6). SECY., G. E. Wright, Jr., Dooly Building.

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, 3rd Wed. PRES., T. B. Carpenter, 8400 Millard St. SECY., C. G. Conaway, Jr., 4701 Colley Ave. (5).

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, 2nd Wed. PRES., W. C. Reamy, Jr., 720 Mills Bldg. (6). SECY., S. H. Robbins, Jr., 2117 M Street, N.W. (7).

● **WEST TEXAS:** 1953. Hdqrs., Lubbock, Tex. Meets, 1st Tues. PRES., R. S. Carow, P.O. Box 3206. SECY., H. L. Mayes, P.O. Box 151.

● **WESTERN MASSACHUSETTS:** 1955. Hdqrs., Springfield. PRES., R. E. Cross, 114 Boston Rd. SECY., F. A. Ferraro, 172 Chestnut St.

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, 2nd Mon. PRES., S. M. Paganelli, 47 N. Division Ave. SECY., B. J. Walter, 333 Fuller Ave., N.E.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, 2nd Mon. PRES., C. W. Kaupp, 271 Delaware Ave. (2). SECY., J. P. Guerra, 34 E. Depew Ave. (14).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, 3rd Mon. PRES., I. J. Rossiter, 231 W. Wisconsin Ave. (3). SECY., R. D. Rodwell, 152 W. Wisconsin Ave. (3).

SPECIAL BRANCH

● **SWITZERLAND:** 1952. Hdqrs., Zurich. PRES., H. C. Bechtler, Anemonenstrasse 40 (47). SECY., Walter Hausler, Erbstrasse 2, Kusnacht.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRES., Alvah Ehrman, Box 4502, State College Station. SECY., R. W. McDonald, 2502 St. Mary's St.

● **OKLAHOMA A. & M. COLLEGE:** 1950 Hdqrs., Stillwater, Okla. PRES., C. E. Durrett, 1215 College. SECY., R. M. Jauch, 308½ W. Maple.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, 1st Wed. after 1st Tues. PRES., P. I. Anderson, 202 N. 10th. SECY., D. W. Strahan, 233 Mall St.

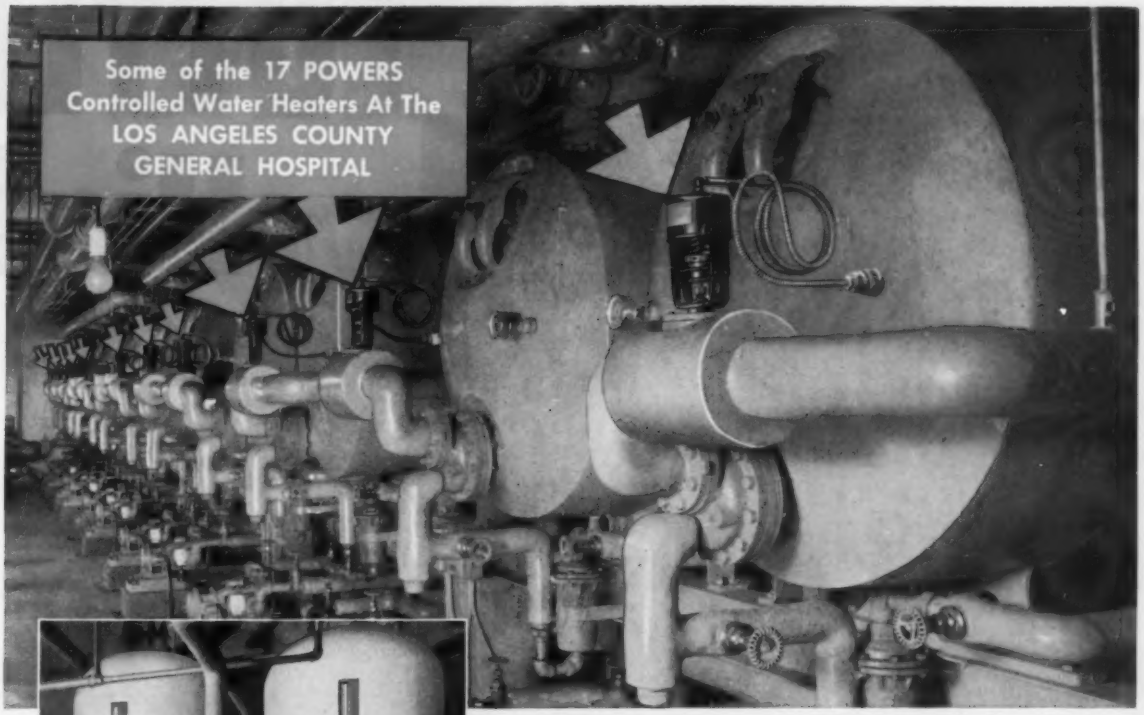
● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. PRES., D. B. Doucette, Purdue Student Branch, ASHAE, School of Mech. Engrg. SECY., J. W. Deabler, Purdue Student Branch, ASHAE, School of Mech. Engrg.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, 2nd and 4th Tues. PRES., D. F. Carroll, Box 6264. SECY., C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

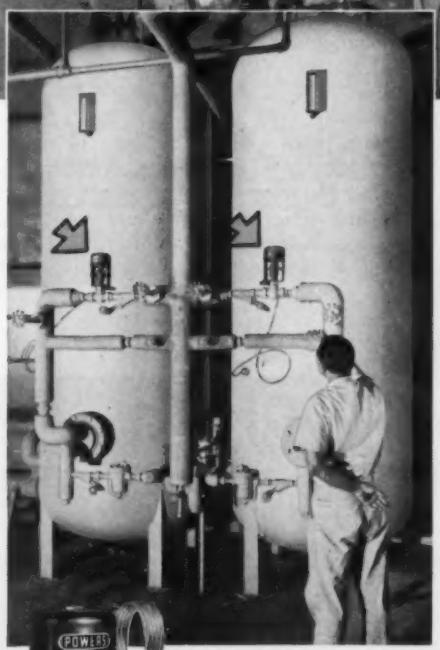
● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, 1st Tues. PRES., J. C. Rumpf, 18511 Muirland (21). SECY., L. J. Hayes, Jr., University of Detroit.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, 1st and 3rd Tues.

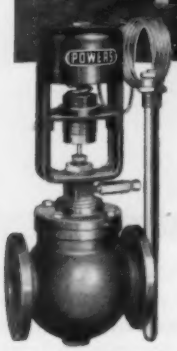
● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont., Canada. PRES., W. A. Stewart, 86 Roxborough St. W. (5). SECY., R. M. Davies, 144 Manor Rd., E.



In 1933 Howe Bros., Contractors, installed 15 Powers Regulators here. All are still in operation, only 11 are shown in photo above.



Above: 1955 installation of Powers Controlled Water Heaters in Contagious Disease building. Contractor: E. Willardson Company.



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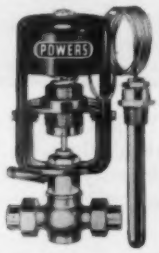


POWERS No. 11 Self-Operating TEMPERATURE REGULATORS
Give Better Control • Last Longer • Save More Money

"after 22 Years *of good service*

POWERS

No. 11 Self-Operating
TEMPERATURE
REGULATORS

are still giving dependable control"

Reports Mr. Louis J. Koch, Senior Master Mechanic

Performance records like this are not unusual with Powers regulators. With today's high cost of maintenance Powers time proven QUALITY controls are a more profitable investment than ever before.

More POWER$ to You — when you want thermostatic control for water heaters, heat exchangers, heating and air conditioning systems or processes.

Automatic control pays big dividends . . . *IF* you have the right type of control and proper size valves for your requirements. Make sure, call POWERS nearest office for help with your problems.

POWERS CONTROL

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

Over 60 years of Automatic Temperature and Humidity Control

TUTTLE High

Seaman's Bank for Savings . . .
First entire building in New York City to use *double duct mixing plenum high pressure system* features complete flexibility of heating/cooling zone control.

Architects: *Halsey, McCormack & Helmer*
Consulting Engineer: *Edward E. Ashley*
General Contractor: *William L. Crow Construction Co.*
Air Conditioning Contractor: *Alvord & Swift*

Photograph taken during construction of Seaman's Bank for Savings showing installation of Tuttle & Bailey Type MPW Double Duct Mixing Plenum Wall Units.

Typical view of a general office area in Seaman's Bank for Savings showing how Tuttle & Bailey Type MPW Units blend with modern architectural design and decorative scheme.

ENGINEERED PRODUCTS FOR AIR CONDITIONING,

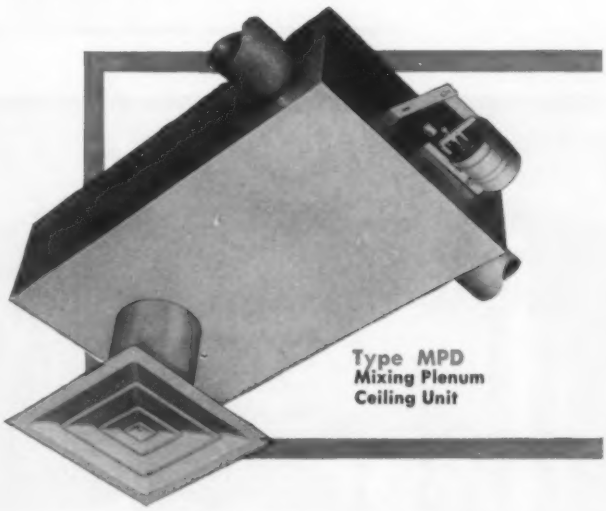
& BAILEY Pressure Units

give SEAMAN'S BANK for SAVINGS

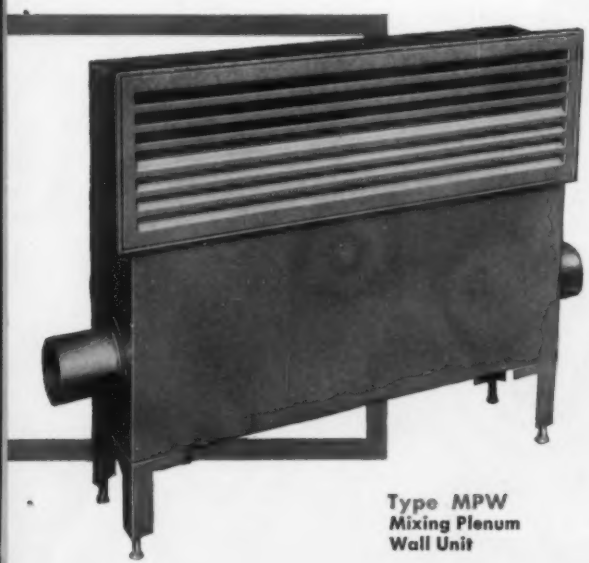
indoor weather that satisfies everybody!

IN THIS modern twelve-story addition to Manhattan's financial district, Tuttle & Bailey High Pressure Units will provide efficient, economical year-around heating and cooling comfort . . . Type MPW Wall Units are located under all windows throughout the building, in banking areas and private offices . . . Type MPD Ceiling Units are installed in the dining areas.

Operating on an all-air system, these double duct units mix and discharge varying proportions of heated and cooled air to provide a constant volume at the exact temperature desired in individual areas. This flexibility means one area can be heated while another is cooled regardless of time of day or season.



Type MPD
Mixing Plenum
Ceiling Unit



Type MPW
Mixing Plenum
Wall Unit

Savings in overall building and installation costs were effected by the use of conduit risers and branches which reduced floor-to-floor dimensions . . . a single primary equipment room resulted in more useable space . . . and the need for supplementary equipment required for the operation of other types of systems was eliminated. In addition, utilization of 100% outside air for cooling when temperature permits will save the cost of operating compressors, pumps, and cooling tower during such periods.

For complete information on the advantages of a high pressure air distribution system in new construction — or for remodeling — get in touch with your nearest Tuttle & Bailey Representative or write for Catalog No. 109 and Bulletin No. 110.

TUTTLE & BAILEY INC

NEW BRITAIN, CONN.

VENTILATING AND HEATING

Trane CenTraVac now in new larger sizes!

Never before these features

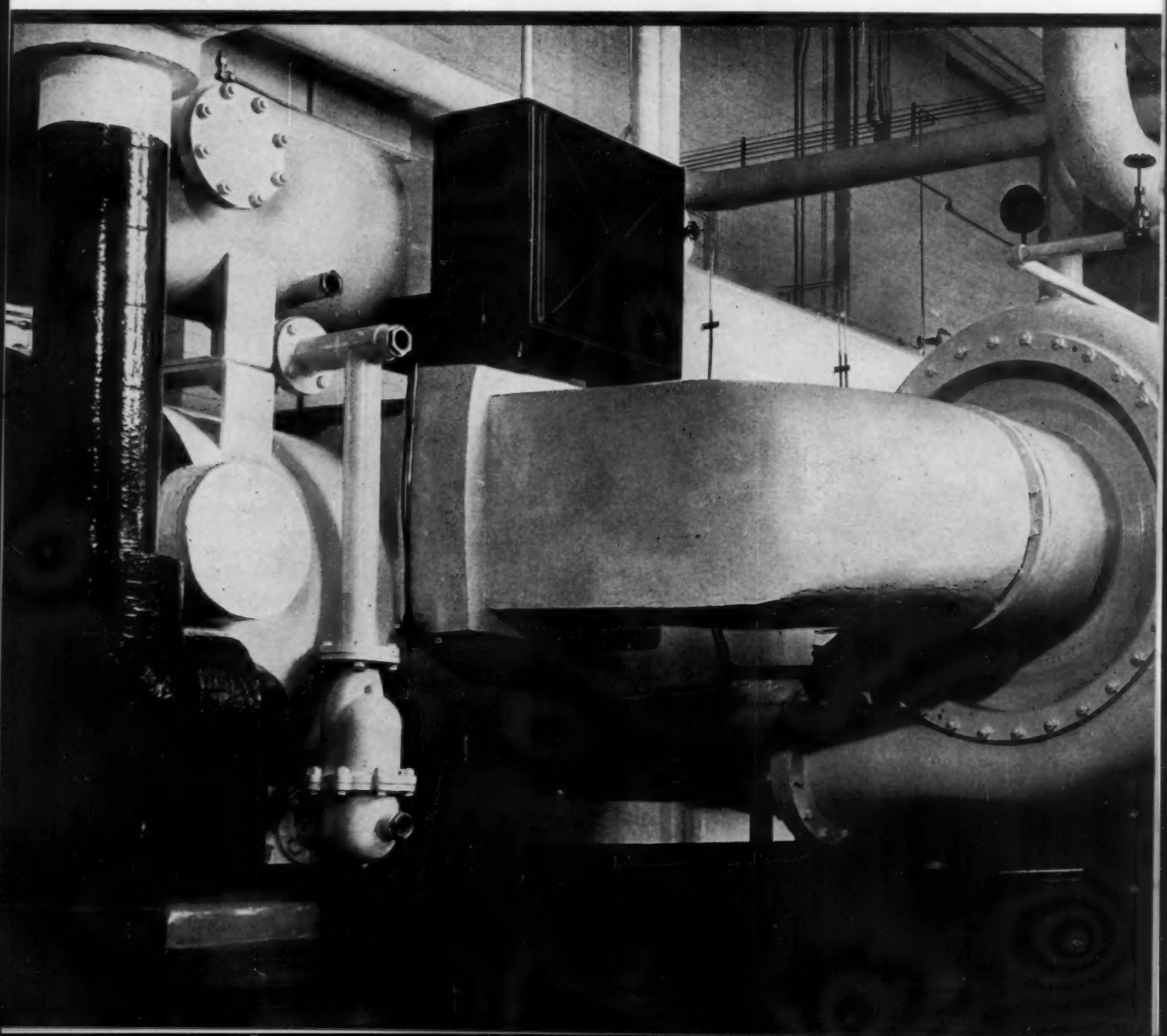
(1) HERMETIC CONSTRUCTION (2) FULLY AUTOMATIC OPERATION (3) STABLE OPERATION DOWN TO 10% OF CAPACITY

All the features of the famous Trane centrifugal that outsells all others combined!*

45 to over 800 tons water chilling capacity—in 11 basic compressor sizes!

Three completely new compressor sizes for your "big" jobs! And easier selection on *every* job because all the commonly used combinations of compressor, evaporator and condenser are covered by complete performance tables in TRANE CenTraVac literature.

In these new, larger sizes you get the same advanced features, the same efficiency and dependability that have made



*Based on Dept. of Comm. figures for units in same size range.

in water chillers to 800 tons!

TRANE CenTraVac the fastest selling centrifugal in the entire industry in its size range. For example:

True hermetic design. No shaft seals to cause Freon loss. No gear box, heavy thrust bearings and couplings to require constant attention and maintenance.

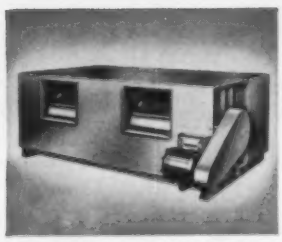
Automatic, unattended operation. No need for full time supervision. Push a button to operate . . . from there on the CenTraVac starts, stops and modulates automatically!

Modulation to 10% of capacity. CenTraVac adjusts its use of power in almost direct ratio with the cooling load—from 100% down to 10% of capacity. You can provide for partial-load operation without the usual penalty in operating costs.

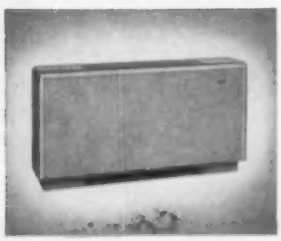
Easy installation, less maintenance. CenTraVac has only *one* major moving part, only *two* main bearings . . . and operates only when full oil pressure is applied to *both* bearings. Compressor is *factory aligned*, completely eliminating this problem in the field. Operation is always smooth, vibration-free.

No multi-level base required. CenTraVac may be set directly on any level concrete floor of sufficient strength to support its weight. No foundation bolts required.

For complete information on this *complete line* of TRANE CenTraVac hermetic centrifugal compressors, call your nearby TRANE Sales Office, or write TRANE, LaCrosse, Wisconsin.



TRANE Climate Changers—full line of factory-assembled air conditioners. 600 to 29,000 cfm.



TRANE UniTrane units—for multi-room air conditioning. Free-standing, recessed or ceiling models.

TRANE

MANUFACTURING ENGINEERS

One source, one responsibility for:
Air Conditioning • Heating • Ventilating
Heat Transfer Equipment

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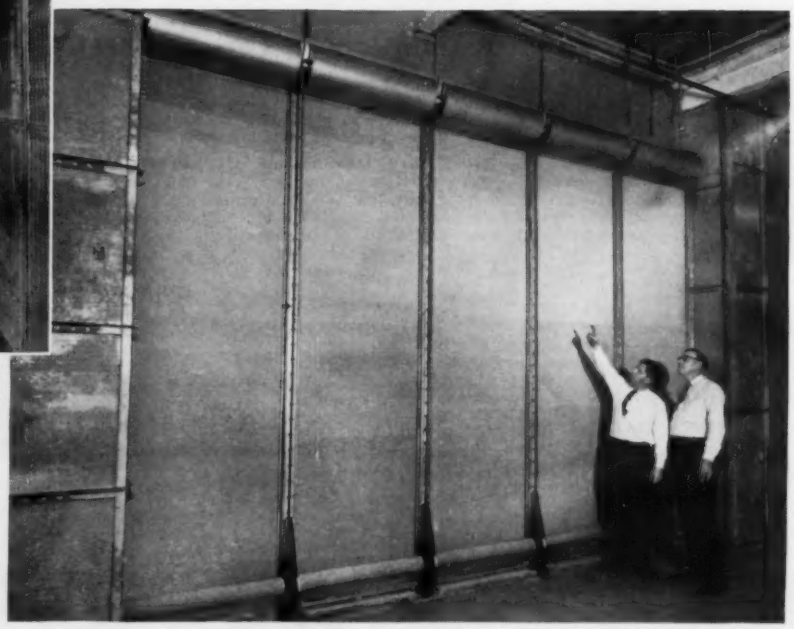
AAF FILTER TEAM CLEANS UP A *Dirty Story*

ABOVE: Final cleaning operations are handled by AAF ELECTRO-MATIC electronic precipitators, thus assuring the spinning room of *super-clean* air.



RIGHT: The front line against impurities in 86,000 cfm of outdoor and re-circulated air to the spinning room is held down by a bank of AUTO-AIRMAT filters. AUTO-AIRMATs on another system supply 60,000 cfm of clean air to the carding room.

Engineered and designed by J. E. SIRRINE & CO., Greenville, S. C.
Installed by THE BAHNSON COMPANY, Winston-Salem, N. C.

Johnston Manufacturing Eliminates Discoloration Losses with Auto-AIRMAT | *Electro*-MATIC Installation

YARN discoloration from dust and soot was costing Johnston Manufacturing Company, Charlotte, N. C., thousands of dollars yearly. Then AAF's No. 1 textile team, consisting of AUTO-AIRMAT and ELECTRO-MATIC filters, took over cleaning both intake and re-circulated air for the spinning room.

Result: during the first year of operation, *not one cent* has been lost due to discoloration.

Here's how these two filters complement each other in producing super-clean air. Lint and coarser dust particles are collected by the AUTO-AIRMAT. Then the ELECTRO-MATIC electronic precipitator adds the finishing touches with the removal of microscopic impurities and smoke. The maintenance story is just as good as the efficiency story—each unit cleans both the air *and itself* automatically!

For complete information on these two filters, call your local American Air Filter representative, or write direct for AUTO-AIRMAT Bulletin No. 234 and ELECTRO-MATIC Bulletin No. 250.

AAF herman nelson

American Air Filter
COMPANY, INC.

American Air Filter of Canada, Ltd., Montreal, P. Q. • 373 Central Avenue, Louisville 8, Kentucky

Iron... Steel... Bronze...
Special Alloys **and now...** *PLASTICS!*

WALWORTH PVC

globe and diaphragm valves

pipe and fittings

CORROSION-RESISTANT TO GIVE YOU NEW AND LASTING PROTECTION!

Walworth rigid plastic polyvinyl chloride valves, *and* fittings provide safe, trouble-free lines to handle wet and dry hydrogen gas—sulphur dioxide—dilute nitric acid—sulphuric acid—natural gas—sugar juice—milk—vinegar—tanning solutions and literally scores of other corrosive as well as noncorrosive materials in the chemical, petroleum, pulp, paper, food and other industries.

Walworth polyvinyl chloride valves *and* fittings are molded to the *same* rigid Walworth specifications by the *same* molder—the General American Transportation Corporation—of the *same* basic material,—Geon rigid vinyl from B. F. Goodrich Chemical. Rigid plastic pipe of the same materials and made by the same molder is also available. Consistent performance is therefore assured throughout *all*-Walworth PVC piping systems. Plastic valves, fittings, and pipe offer the following advantages:

1. **Exceptionally resistant to most salts, alkalis, and nonoxidizing acids at temperatures below 150° F.**
2. **High burst strength and impact resistance.**
3. **Nontoxic, and extreme low flammability.**
4. **Easy to install.**

Get the complete Walworth PVC product story. Write for brochure containing detailed specifications, characteristics, and application data.

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valves . . . pipe fittings . . . pipe wrenches

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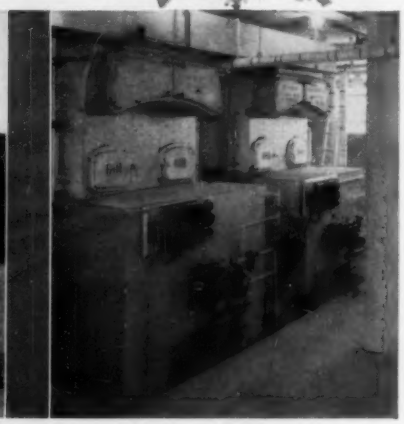
WALWORTH COMPANY OF CANADA, LTD.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Wherever Disaster Strikes...



The beautiful Hospital San Carlos, Bogota, Colombia, one of the finest in South America, is equipped with Kewanee Boilers.

Architect: Cuellar, Serrano, Gomez & Co. Ltd.; Consulting Architect: Smith, Erickson & Garden; Engineer: Cuellar, Serrano, Gomez & Co. Ltd.

Two No. 588, 125 lb. Kewanee Boilers installed in the Hospital San Carlos in Bogota, Colombia. They assure power expansion when needed—an important factor when the lives of patients are at stake.

HOSPITALS THE WORLD OVER DEPEND ON

KEWANEE reserve plus rated boilers

WITH 50% EXTRA POWER

WHEN steam power may mean life or death to hospital patients . . .

WHEN emergencies demand maximum temperature, split-second sterilization of instruments . . .

WHEN unfailing power is needed to bring light to the delicate techniques of modern surgery . . .

WHEN the operating rooms of hospitals are theatres of extreme urgency . . .

That is when Kewanee Reserve Plus Rated Boilers become a necessity—because they have the reserve power for additional capacity requirements.

With a rating plan based on the commercial code of the Steel Boiler Institute, Kewanee Boilers certify 50% or more extra built-in power. This extra power assures the ability to treat more sufferers when epidemics or disaster strike. Modern hospitals must have the foresight to prepare for major disasters such as earthquakes, tornadoes, fires and accidents which bring masses of emergency cases to the operating rooms.

Kewanee Boilers, rated on nominal capacity with built-in reserve, can take care of expanding loads created through disaster. They offer "cruising speed" operation which means savings on fuel and repairs. Choose Kewanee and be prepared if disaster strikes.

KEWANEE BOILERS

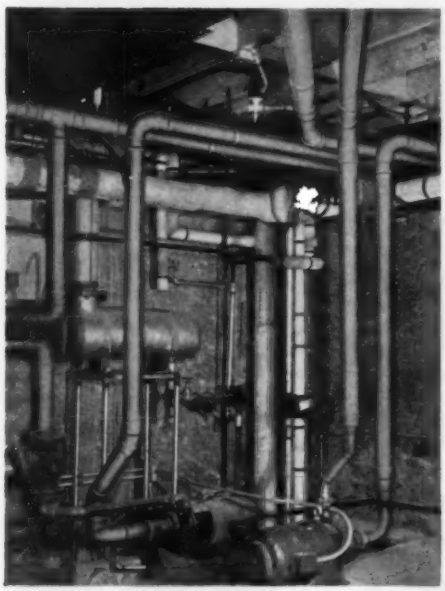
KEWANEE-ROSS CORPORATION, Kewanee, Illinois

Division of American Radiator & Standard Sanitary Corporation

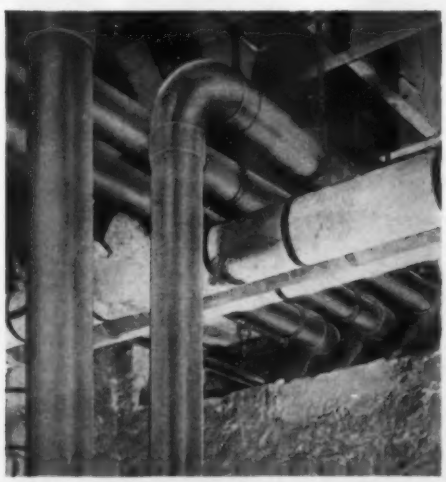
Serving home and industry - American Standard - American Blower - Church Seats & Wall Tile - Detroit Controls - Kewanee Boilers - Ross Exchangers - Sunbeam Air Conditioners

You can depend on KEWANEE engineering

AnacondA Copper Tube and Fittings cut installing time in half, says contractor



AnacondA Copper Tube installed in the air conditioning machine room.



Note how neatly and compactly the copper tube was installed—through small openings in the massive old masonry walls.

Frank Tvrdik, plumbing contractor, P. T. Chandler and Clark Chandler of the Chandler Co., Anaconda distributors, and John Allen, District Sales Manager, The American Brass Co., discuss details of piping at the First Avenue Building. (Left) The building as it appeared before modernization.

Skogman Construction Co., General Contractor, Architect and Owner

Copper helps turn a venerable landmark into the "Cinderella" building of Cedar Rapids

The Rock Island Building in Cedar Rapids, Iowa, a sound old landmark, has been transformed into the First Avenue Building, the most modern, comfortable, convenient office building in the city. One of the big modernization problems was the handling of refrigeration and water service. Frank Tvrdik of Midwest Plumbing & Heating Co., plumbing contractors, used AnacondA Copper Tube throughout.

"Copper made the installation practical," says Frank Tvrdik. "Because the O.D. of copper tube is smaller and solder-type fittings are trim and compact, I could run lines through small openings and inside existing partitions. The 20' lengths reduced the number of fittings and the elimination of pipe-threading was a big time-saver. I saved additional time by prefabricating assemblies at the shop. Total time of installing the copper tube lines was half of what it would have been with ferrous pipe, which meant a considerable over-all saving on the job."

Find out how you can save by using AnacondA Copper Tube and Fittings. For information write The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass, Ltd., New Toronto, Ont. 8517

ANACONDA®

Copper Tubes and Fittings

Available through Anaconda Distributors

NEW
REMINGTON STUD DRIVER
Interchangeable barrels for
¼″ and ⅜″ studs
Operator can change from one barrel to the other in seconds, right on the job! No time lost in going from medium- to heavy-duty work—no need for *second* tool!
A squeeze of the trigger and the job is done!
Anchoring wood furring to steel . . . steal angle to concrete
Compact tool can be used overhead, in tight places—anywhere a man can go. No outside power source required!

tool cuts costs on all stud fastening jobs!

with the Double-Duty

REMINGTON STUD DRIVER

You can anchor both ¼" and ⅜" studs in steel or concrete... instantly!

Here's the first cartridge-powered tool that can cut your costs on practically all construction fastening—light, medium and heavy duty. It's the new Model 455 Remington Stud Driver!

The secret of this amazing versatility lies in the tool's construction. *Two* sizes of studs can be used—¼" and ⅜". Changeover in barrels takes only 90 seconds *right on the job*. With either size, an operator can set up to 6 studs per minute . . . anchor conduit clips, wood sections, steel frames and many more fixtures with a squeeze of the trigger!

What powers the Stud Driver? Remington 22 and 32 caliber cartridges for the ¼" and ⅜" studs respectively. For special medium-duty applications, the smaller cartridge may be used with the larger stud, giving an extra-strong fastening at a saving. Every stud is driven arrow-straight, whatever the combination.

GET ALL THE FACTS about this new, useful fastening tool that goes anywhere, works anywhere—without wires or cables, hammering or predrilling. The Model 455 Remington Stud Driver makes the toughest fastening job a one-man, one-tool job and saves you time and money with every application! Just clip the coupon below for full details.

"If It's Remington—It's Right!"

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Remington Arms Co., Inc., Bridgeport 2, Conn.

Please send me your free booklet which shows where and how to use the cost-saving Remington Stud Driver fastening method.

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HPAC-10

One of the country's largest air-terminal buildings, at San Francisco International Airport, uses Beth-Co-Weld Pipe in sizes from ½ in. to 12 in. *Plumbing and Heating Contractors:* Anderson and Rowe; *Jobbers:* Heieck and Moran, and P. E. O'Hair, all of San Francisco.

Beth-Co-Weld Pipe is used in sprinkler system for this new Simplex Paper Company's bag manufacturing plant, Jacksonville, Fla. Installation by Moore Pipe & Sprinkler Company, Jacksonville.

New Air-Terminal Building... New Factory Both with Beth-Co-Weld Piping

Whether it's for a factory, air-terminal building, or some other type of construction, you'll make a wise choice when you select Beth-Co-Weld steel pipe for the heating and plumbing lines, and for sprinkler systems.

Beth-Co-Weld is good, sound, dependable pipe, manufactured by the continuous-weld process. It is uniform in quality, and is easy to work.

Beth-Co-Weld is furnished in sizes ranging from ½ in. to 3 in., standard-weight and extra-strong, and can be supplied either in random lengths or in uniform 21-ft lengths, plus or minus 1 in. It also comes in 3½ and 4 in. sizes, standard-weight only, in lengths of about 22 ft. Order Beth-Co-Weld today from your jobber.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

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The design of an expansion joint is, to Zallea Brothers, a vital matter. Not design aimed at lowering our production costs. Not design that attempts to provide a single cure-all for every problem involving joints. Zallea design is aimed at producing the best expansion joint possible to fill a specific set of requirements —design that gives the user a superior product and the very best possible service. Actual tests have proved Zallea Expansion Joints outlast all other packless joints. Performance records like this prove superior design and construction.

Zallea design engineers are always available to help solve expansion joint problems. The best help possible is as handy as your phone or mail box. And while you're at it, request Bulletin 351—our condensed catalog of standard types. It's free. And without obligation.

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World's Largest Manufacturers of Expansion Joints

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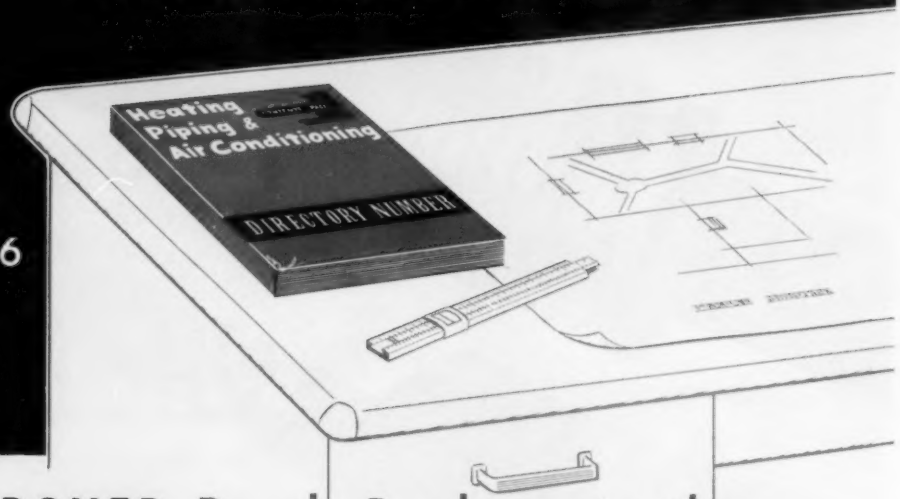

A PROVED Result-Producer in the Heating, Piping, Air Conditioning Market

When engineers and contractors look for sources of supply, here's where they go.

Want proof? A survey established that **9 out of every 10** of our subscribers (all paid—ABC) use this January Directory Number when specifying and purchasing. In a great many cases, it's referred to every week.

What's in it for THEM? Plenty.

An alphabetical listing of all the products used in industrial and large building heating, piping and air conditioning. Names and addresses of all the manufacturers of these products. A listing of all known trade names. A convenient guide indicating the various products advertised in this issue and the manufacturers' names. And, of course, the normal editorial content of a regular issue.

Field-specialized and kept completely up-to-date, our Directory Number for 21 years has been the **accepted** Buyers' Guide, the only authoritative reference work of its kind available to your prospects and customers.

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Here's an unmatched opportunity to keep your product story before potential buyers all year long. Throughout 1956 over 18,000 dog eared, well-thumbed copies will serve on your sales force.

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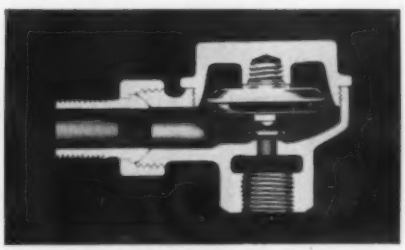
A glance at this photograph quickly tells the entire story. Dunham's flat valve disc closes *flush* against the trap seat. Since Dunham's flat disc does not fit *into* the seat . . . isn't tapered or conical . . . there's less chance for erosion, wear or wire-drawing.

Dunham Radiator Traps always assure easy passage of air, water and foreign matter. No clogging. Extra-large, non-clogging seat opening is unrestricted by any guide. There are no bellows to stick, no field adjustments to make.

Steam Specialties are our specialty . . . and have been since we perfected the first commercially successful thermostatic trap over 50 years ago. Next time you need anything at all in the steam specialties line, do as so many have done for so long—*Depend on Dunham for all your needs.*



Dunham Radiator Trap
3 sizes: 6 patterns; to 700 EDR

Clip and mail coupon for full information

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RADIATION • CONTROLS • UNIT HEATERS • PUMPS • SPECIALTIES
QUALITY FIRST FOR OVER FIFTY YEARS
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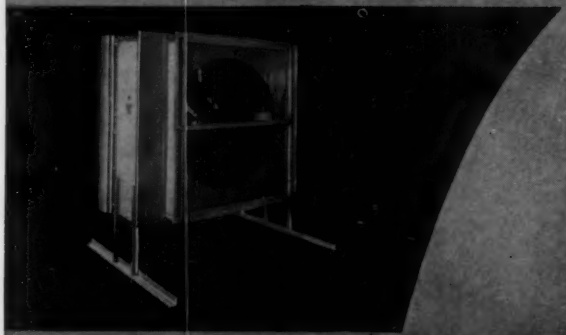
STOP *using water!*

Eliminate all water problems with UNICON by KRAMER. Any size compressor, regardless of tonnage, can be air-cooled with UNICON.

KRAMER UNICON



Stands, hoods, and wind deflectors are available for simplified outside mounting
You need nothing else!

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think of

HUSSEY COPPER

AND YOU'LL ENJOY THESE IMPORTANT ADVANTAGES

1. Lifetime durability and good appearance
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4. Ready availability that recommends Hussey Copper as standard

Hussey Copper offers you all these features plus dependable top quality and uniformity that makes it advantageous to always specify "Hussey Copper." Mill service is available on mill-run quantities including finishing services such as shearing, slitting or special heat treating. For stock items call on any of the seven complete Hussey Copper Warehouse stocks listed below.

HUSSEY

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Rods • Wire • Tubing
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C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
ROLLING MILLS AND GENERAL OFFICES
PITTSBURGH 19, PA.

Seven Convenient Warehouses
• CHICAGO • NEW YORK
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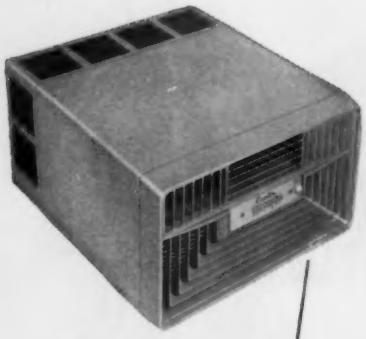


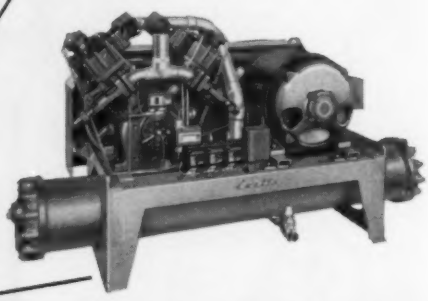
Window Air Conditioners

Packaged Air Conditioning units—2 to 20 tons

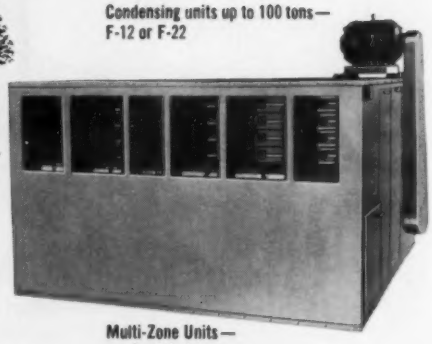
More jobs... More profit!

WITH THIS

complete Curtis LINE

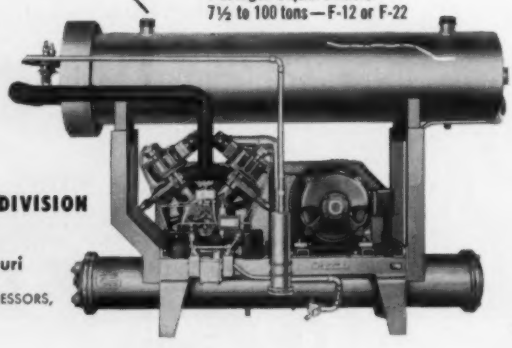


Condensing units up to 100 tons—F-12 or F-22



Multi-Zone Units—serving 2 to 8 zones

Packaged Liquid Chillers—7½ to 100 tons—F-12 or F-22



You'll sell more jobs, and make more profit, with this well-rounded Curtis line. Curtis equipment sells readily because it is backed by one of the oldest and most respected names in the business. Curtis products are presold for you by hard-hitting national advertising in *Saturday Evening Post, Time and Newsweek*, plus many national business and trade magazines.

WRITE TODAY for information on how you can obtain a Curtis direct factory franchise.

Curtis REFRIGERATING MACHINE DIVISION

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1950 Kienlen Avenue, St. Louis 20, Missouri

Other Curtis Products: INDUSTRIAL AND AUTOMOTIVE AIR COMPRESSORS, AUTO LIFTS, CAR WASHERS, AIR HOISTS

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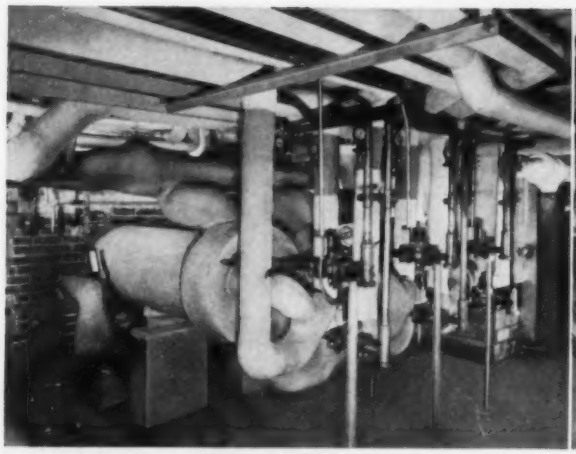
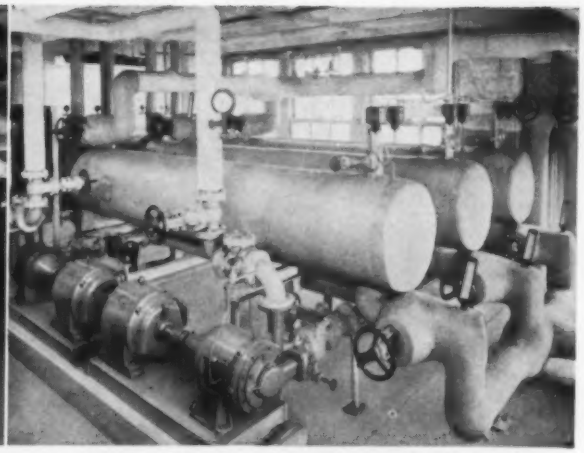


These three p-k Freon coolers, located in the basement, protrude through brick wall to save space.



Fifth floor installation shown here conditions upper floors. Third floor chillers serve cooling tunnels.

for perfect candy kitchen weather

LOFT'S USES p-k COOLERS

Schwerin Air Conditioning Corp. specified Chrysler Airtemp Units with p-k chillers to keep Loft's 8-story Long Island candy kitchen at just the right temperature and humidity for candy perfection.

You've seen soft, sticky, unappetizing candy you wouldn't want to eat. But you won't see it at Loft's. This big Eastern candy manufacturer has an unusual ability for maintaining the highest standards of quality 'buy-appeal'. And one important reason is its thorough-going air conditioning system employing Chrysler Airtemp units and six **p-k** dry expansion Freon coolers, engineered and installed by Schwerin Air Conditioning Corp., New York.

At Loft's both humidity and temperature must be rigidly controlled, for when humidity gets out of hand, candy is unsaleable.

So the reheating principle is used to cool the air, and "wring" it to the proper humidity. "Two-circuit" type **p-k** Freon coolers which chill a glycol solution are located in the basement and the third and fifth floors, to serve nearby areas. Air from conditioned areas passes around coils chilled by the glycol solution and air temperature is reduced some 25°F. to 43°F. A water spray cleans the air, and increases its humidity to 97%. Then the air is circulated around heating coils where its temperature is raised to 60°F. and humidity reduced to 51%—just the right "weather" for perfect candy-making.

The six **p-k** Freon coolers are automatically controlled; operation is simple. Because the coolers are enclosed, the Loft system is a *clean* system. Compact **p-k** Freon coolers require minimum floor space, minimum insulation.

If you, like Loft's, have a tough "indoor weather" problem, **p-k** heat exchange specialists would be glad to assist. More than likely they'll have answers to your particular questions. Write today for illustrated literature and engineering suggestions.

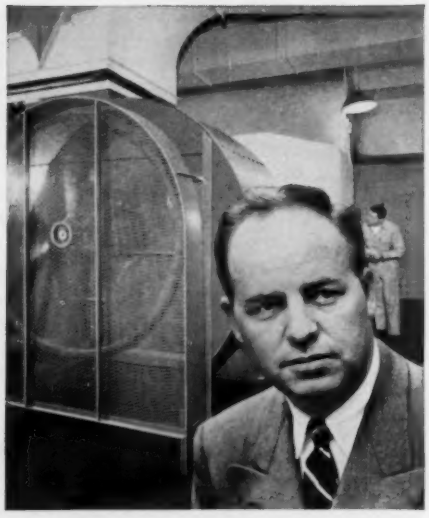
The Patterson-Kelley Co., Inc., 800 Burson Street, East Stroudsburg, Pa.

PATTERSON-KELLEY

Offices: 101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

New John Wanamaker Department Store, Wynnewood, Pa. Architects: Wallace & Warner; consulting engineers: Stewart A. Jellett Company; heating and ventilating contractors: Daniel J. Keating Company—all of Pennsylvania.

American Blower supplies the weather in Wanamaker's new suburban store



"Quiet operation is a big benefit of American Blower equipment," says Daniel J. Keating, Jr., air-conditioning contractor. "For over 37,000 cu. ft. of air is filtered, conditioned, recirculated every minute."

Except for entrance-and-exit doors, the new three-floor John Wanamaker Department Store in suburban Philadelphia has no exterior openings. Yet it is always comfortable inside, thanks to American Blower equipment—which furnishes conditioned air, summer and winter, to maintain an even and desirable temperature. Each store level has its own American Blower supply and return system.

Says Wanamaker's chief engineer, Frank Mescal—"In selecting air-handling equipment, one of our main requirements was that it must be free of noise and vibration. American Blower equipment was the perfect choice. For not only has it proved quiet, but trouble-free in operation as well."

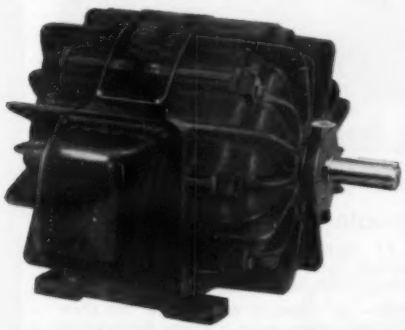
If air conditioning is in *your* plans, why not talk to an experienced representative—at our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

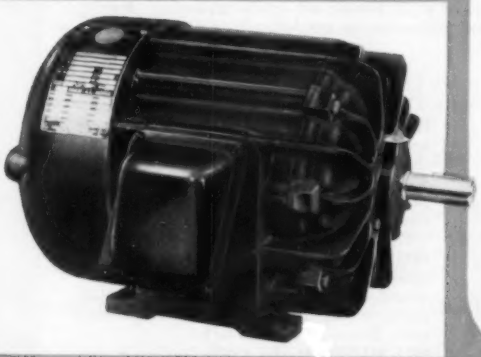
AMERICAN BLOWER

DUST-PROOF!
MOISTURE-PROOF!

TWO NEW DIEHL MOTORS FOR "Air-Over-Motor" APPLICATIONS



Type "DIE" Motor (Not Fan-Cooled)



Type "DIF" Motor (Fan-Cooled)

When you buy or specify motors for fans, blowers, unit heaters, air conditioners, cooling towers or dehumidifying systems *don't overlook* these two new standard or custom-designed Diehl Totally-Enclosed Motors.

Smaller in size, lighter in weight, precision-engineered and precision-built to new NEMA standards, they are ideally suited to "air-over-motor" applications where moisture, fumes, dust and other airborne particles are a problem ... a field in which Diehl has long been a leader.

Diehl

Tops in Quality—
Competitive in price!

DIEHL MANUFACTURING COMPANY
Electrical Division of THE SINGER MANUFACTURING COMPANY
Finderne Plant, SOMERVILLE, N. J.

Please send me the following bulletins:

☐ New Type "D" Motor Bulletin No. HP-3304
☐ Consolidated Catalog & Price List No. HP-3310

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Company_____
Street_____
City_____ State_____

INTEGRAL AND FRACTIONAL HORSEPOWER MOTORS ARE AVAILABLE IN A WIDE RANGE OF TYPES AND SIZES

Sell More Heaters

THERE IS A JOHN ZINK HEATER FOR EVERY HEATING NEED

Prospects don't walk away when you show JOHN ZINK Heaters — they buy! For both home and industry JZ Heaters offer customers just what they need in heating: automatically controlled even heat, fuel economy, utmost safety, and quiet operation. JZ Heaters are available in four popular models and many sizes—upright or horizontal CENTRAL HEATERS, louvre or radiant WALL HEATERS, UNIT HEATERS and FLOOR FURNACES. All JZ Heaters are AGA approved for natural, mixed or LP Gas.

Why JZ Heaters Are Money Makers

HIGH PROFIT — JZ Heaters bring a high margin of profit because less time is spent selling customers. JZ Heaters almost sell themselves.

EASY INSTALLATION — JZ Heaters are known for their ease of installation, takes only a short time when compared to other heating units.

EASY TO SERVICE — While compactly and sturdily built, all parts of a JZ Heater are easily accessible. Rarely are parts replacements needed.

JZ Heaters in Four Popular Styles

FLOOR FURNACES. JZ gas fired floor furnaces are available in five conventional and short models with input ratings from 30,000 B.t.u/hr. They become a complete one-package heating unit when equipped with safety pilot and automatic temperature control.

CENTRAL HEATERS. Available in Vertical or Horizontal forced air models. Can be installed in attic, closet, basement, utility room, under the floor, or as a suspended unit. From 65,000 B.t.u/hr.

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WALL HEATERS. WH-25 Recessed Wall Heater fits standard 2" x 4" stud partitions on 16" stud centers. Barely 58" high. Available in standard or radiant styles.

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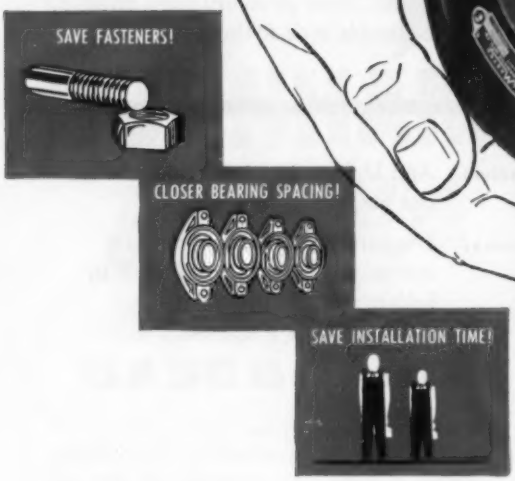

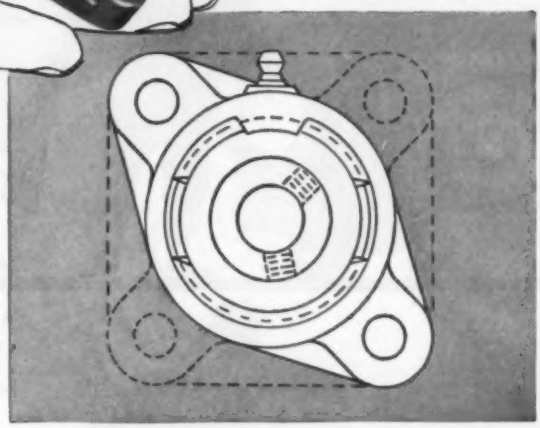

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- Cuts installation costs by eliminating two fasteners and punching or drilling operation required for two mounting holes.
- Permits closer bearing spacing on multiple shaft installations.
- As a replacement bearing unit fits the diagonal bolt centers on present four-bolt flange units.
- Carries the same load rating for a given shaft size as four bolt units.
- Retains all patented design features of SEALMASTER Bearing Units—Zone Hardening, Self-Alignment, Locking Pin & Perimeter Dimple and Labyrinth Seal.
- Available in shaft sizes from ½ to 2 15/16 inches.

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Call your SEALMASTER Distributor or mail this coupon today!

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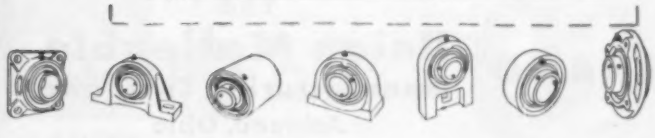

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Canny Canine: Right. Same price ordinary black malleable pipe fittings.

Wholesaler: And U-Cote Black Fittings really last longer?

Canny Canine: Doggone right! Resist rust and corrosion years longer. Tested to hellangone . . . proved it.

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Galvanized and Black U-Cote Malleable Iron Pipe Fittings—Unions—Plugs and Bushings—Cast Brass Solder Joint Pressure and Drainage Fittings—Cast Iron Drainage and Screwed Fittings—Steel Nipples and Couplings—Insert Fittings for Plastic Pipe.

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BURNHAM BASE-RAY

CAST-IRON RADIANT BASEBOARD

Now it's easy to provide correct BASE-RAY* radiation on all jobs! Just use the new No. 9 where wall space is limited or heat losses are great, the No. 7 on normal jobs. Both have the same Burnham streamlined design so appealing to women. Both are made by the pioneers of Radiant Baseboard heating. Make your customers friends for life with a BASE-RAY installation!

*Reg. U.S. Pat. Off.

New! No. 9 (9⅞") IBR rated at 3.45 sq. ft. per lineal ft.

No. 7 (7") IBR rated at 2.35 sq. ft. per lineal ft.

BURNHAM BASE-RAY RADIANT BASEBOARD

BASE-RAY wears like iron ... because it's made of iron

TOPS FOR BEAUTY AND QUIET! BASE-RAY's attractive streamlined design appeals strongly to home owners. It is as inconspicuous as ordinary wood baseboard and can be painted to blend with any decor. It's quiet too. Develops no expansion noises or "pings" in operation.

EASY TO INSTALL! No extra tools or know-how are needed. No special piping layout necessary. Conventional practice is followed in either modernization or new jobs. No system requires less installation labor.

FULLY WATER-BACKED FOR EVEN HEAT! BASE-RAY is filled with water from top to bottom . . . gives off heat long after burner is shut off! Avoids the discomfort of "all-on" — "all-off" types of heating.

First in the manufacture of baseboard heating.

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Please send me full data on BASE-RAY and copy of your new ratings and installation guide.

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CHICAGO'S

Enlarged Line of

FC FLEXIBLE-COUPLED and CC CLOSE-COUPLED Pumps

Gives You

More Choices, More Efficiency

Designed for:

- Water Supply Systems
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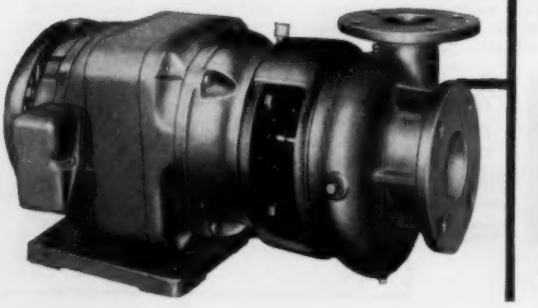
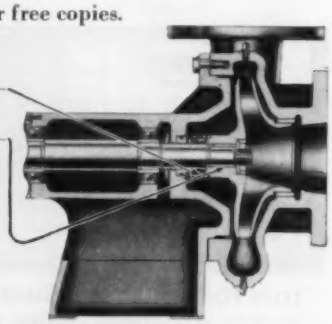
However specialized your need for a circulating pump, you are sure to find the model and size that exactly fits your requirements in Chicago's recently expanded centrifugal pump line. Now you can get high efficiency Chicago pumps in either close-coupled or flexible-coupled models with capacities from 5 to 400 G.P.M. and for heads from 10 to 190 feet. Complete line is described in two new bulletins, Nos. 107 and 108. Write to Dept. D for free copies.



FEATURING THE CERAMIC-FACED SEAL AND SHORT OVERHANG IMPELLER

All Chicago C-C and F-C pumps are equipped with the most reliable mechanical seal ever built into a pump! Ceramic-faced stationary seat is highly resistant to wear. Accurately lapped surfaces and automatic adjustment for wear assures long life under strenuous service. No troublesome packing replacement and maintenance, no shaft wear commonly found with stuffing box seals.



Silence Built-In

Ball bearings close to the end of the impeller insure ample support and alignment for quiet operation always. Impeller is perfectly balanced for vibrationless, noiseless rotation.

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CHICAGO PUMP COMPANY

Subsidiary of Food Machinery and Chemical Corporation

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Condo-Vac ®, Sure-Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems . . Flush Kleen ® Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps. Pumps for every industrial use.

easy to install...

"Easy as putting in a pipe fitting"—that's what it's like to install a Yarway Impulse Steam Trap.

No special supports needed, because Yarways are light in weight, small in size—can be squeezed in most anywhere.

Plus these good features:

- **They get equipment hot in a hurry and keep it hot**
- **Good for all pressures**
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Everywhere users are calling the Yarway Impulse "the little steam trap that does so much." Prove to yourself what it does by trying one for 60 days FREE in your own plant. Write . . .

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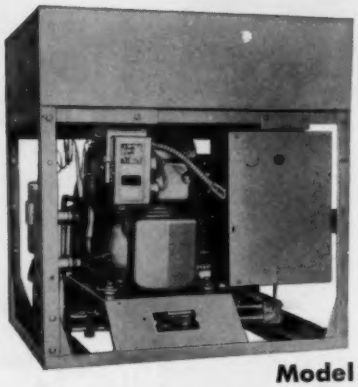
YARWAY **Impulse® steam trap**

OVER 1,000,000 YARWAYS ALREADY SOLD THROUGH 250 CONVENIENT INDUSTRIAL DISTRIBUTORS

Now...a complete line of packaged AMERICAN-Standard Water Chillers for all types of buildings



Model PAS

Model PAS-AC

Model ACS

American-Standard now offers a complete line of quality air-cooled and water-cooled chillers for all air conditioning requirements. These packaged chillers are factory assembled with circuits piped, wired and tested for fast, low-cost installation. All are compactly designed and mounted in a rigid steel frame for easy handling—all have matched components to provide outstanding operating efficiency and economy.

Model PAS . . .

for homes and small commercial buildings. This compact American-Standard Water Chiller is available in 2 and 3 hp sizes. It has a hermetically sealed motor and compressor assembly which carries a 5-year warranty. An attractive 20-gauge steel cabinet is available for the chiller. Both Models PAS and PAS-AC are shipped with an operating charge of Freon 22, eliminating the time and expense of separate system charging.

Model PAS-AC . . .

Now, a packaged water chiller with air-cooled condenser. This unit is ideal for use in homes and small commercial buildings in areas where a scarcity of water exists. This factory-assembled, hermetically sealed water chiller, equipped with a compact air-cooled condenser is available in 2 and 3 hp packaged units. It needs no separate water supply for condenser cooling.

Model ACS . . .

for medium and large sized buildings. Large American-Standard Water Chillers range in size from 7.5 up to 75 hp. They feature low-speed compressors for extra quiet operation. These units are delivered completely assembled; make a few simple piping and electrical connections and this large-capacity chiller is ready to go.

. . . . . .

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AMERICAN-Standard

WATER HEATING-COOLING SYSTEMS

COPELAWELD HERMETICS

Engineered for low-cost operation, powered for years of whisper-quiet performance . . . Copeland combines the most-wanted compressor features into COPELAWELD, the ideal unit for your refrigeration and air conditioning products.

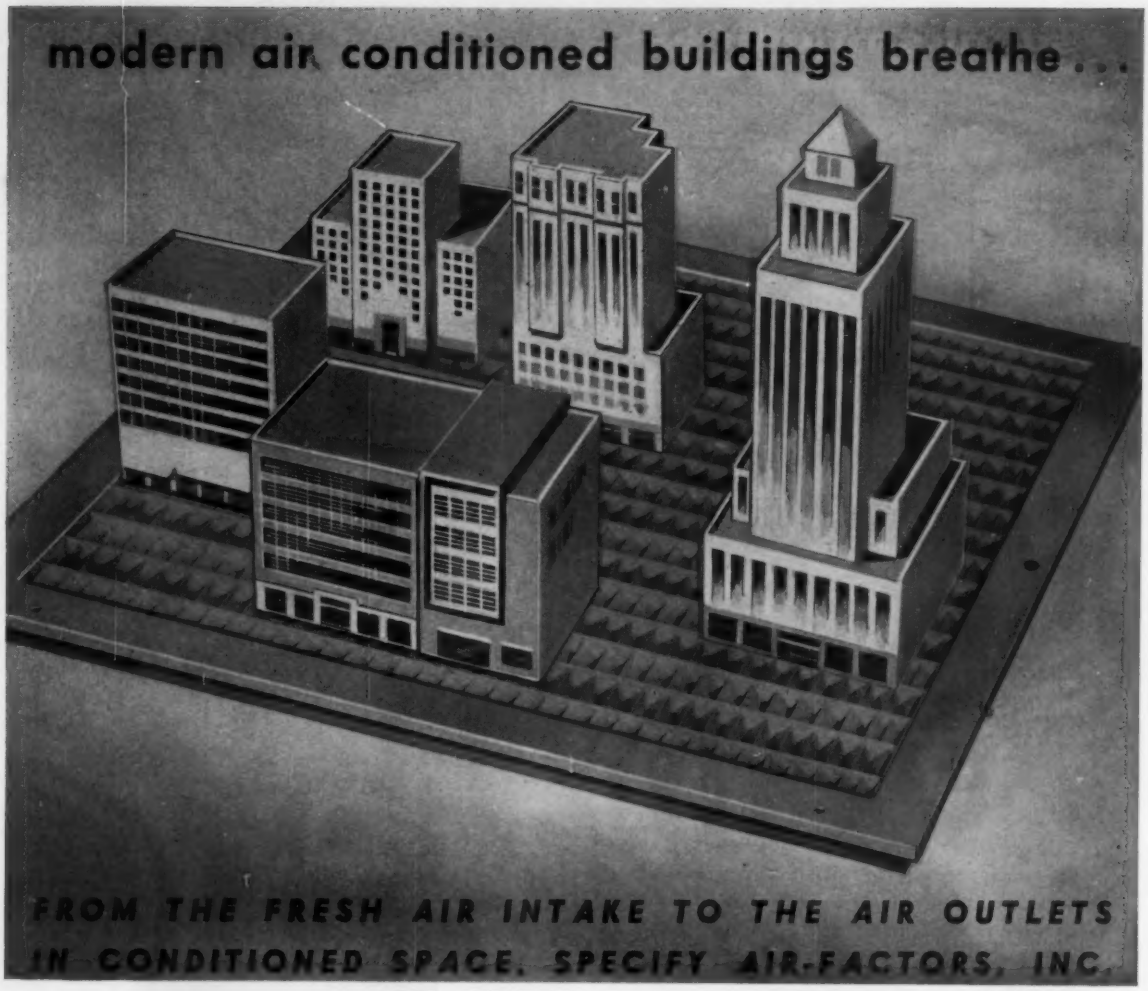
Cool-running two-cylinder Copelawelds are free from vibration and chatter. Heavy-duty, high-power-factor motor delivers exceptionally high capacities at minimum current input. Freon-12 and Freon-22 models. Sizes ⅓ H.P. through 1½ H.P.

Get acquainted with the Copeland welded motor-compressor. Field-test Copelaweld in your own equipment, and sample the performance that is the industry's standard. See your Copeland dealer or write us direct.

COPELAWELD
⅓ H.P. through 1½ H.P.

Copeland
DEPENDABLE *Electric* REFRIGERATION

COPELAND REFRIGERATION CORPORATION
SIDNEY, OHIO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FROM THE FRESH AIR INTAKE TO THE AIR OUTLETS
IN CONDITIONED SPACE, SPECIFY AIR-FACTORS, INC.

The Only

MANUFACTURER OF A COMPLETE LINE OF AIR DISTRIBUTION AND AIR CONTROL EQUIPMENT

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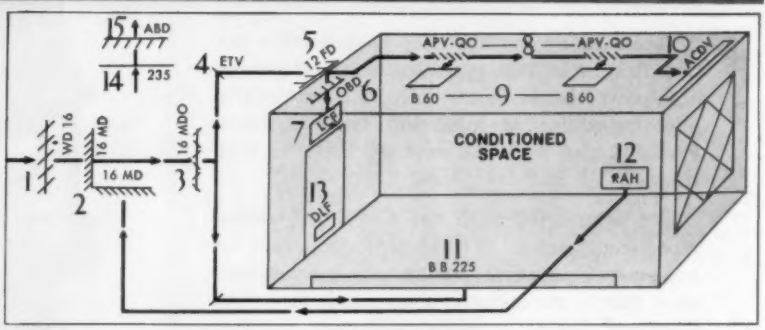


1 — WD16 Fresh Air Intake Louver.
2 — 16MD Fresh Air Return Volume Control Dampers.
3 — 16MDO Face and By Pass Air Mixing Dampers.
4 — ETV Duct Air Turns.
5 — 12FD Fire Damper at Fire Wall.
6 — OBD Opposed Blade Volume Control.
7 — LCF Sidewall Air Diffuser.
8 — APV-QO Quick Opening Volume Control and Extractor.
9 — B6O Ceiling Air Diffuser.
10 — ACD-V Ceiling Air Curtain Diffuser.
11 — BB225 Base Board Air Plenum.
12 — RAH Return Air Grille.
13 — DLF Door Louver.
14 — Model 235 Exhaust Register.
15 — ABD Barometric Back Draft Damper.

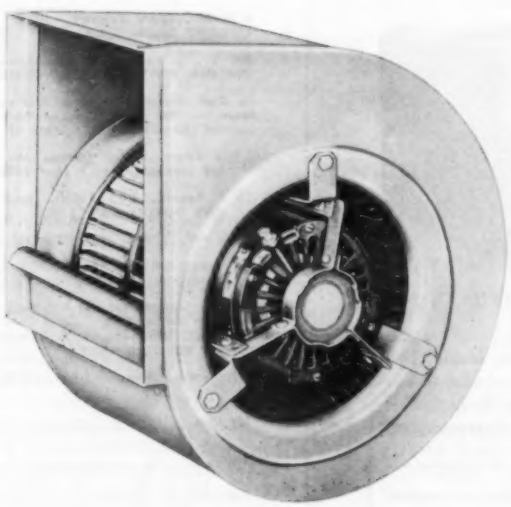
AIR-FACTORS INC

MONROVIA, CALIFORNIA

GO DIRECT TO UTILITY

FOR SILENCE

IN DIRECT DRIVE BLOWERS



A lot of air doesn't have to make a great big noise. As a matter of fact, Utility's Direct Drive Blowers have practically no-sound operation due to the new Neoprene hubs which isolate motor noise and vibration. The first to utilize this far-advanced feature, Utility consistently pioneers in high speed production development. This enables us to pass on to you the top quality of our engineering combined with a rock-bottom price.

Adaptable to the manufacture of heating, cooling, refrigerating and ventilating equipment, these silent direct drive blowers also require less space, have no unnecessary accessories and can be speed-controlled easily.

Tested and re-tested, they are the product of Utility's advanced engineering and low-cost production techniques. You can now offer your customers the kind of equipment that includes silent operation and all other Utility exclusive features. Check Utility for blowers, blower parts or any combination of parts – and discover for yourself . . .

YOU CAN'T MATCH UTILITY FOR PRODUCT AND PRICE

A Division of Utility Appliance Corporation

UTILITY FAN CORPORATION

911 East 59th Street, Los Angeles 1, California

Producers of blowers and blower parts for original equipment manufacturers. Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Write for catalogue data.

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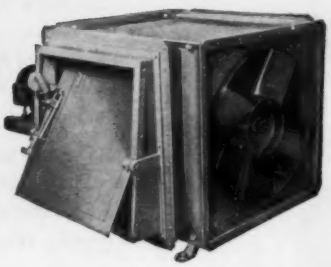
Install a WING motorized DRAFT INDUCER – and end your draft troubles

No more will you have to worry about the effect of weather conditions on your furnace, about lack of draft due to cold chimney after shutdown, about smoke, soot or gases due to poor draft, or low CO_2, resulting in high fuel bills. The WING Draft Inducer eliminates all these troubles, insuring positive, adequate, uniform draft at all times.



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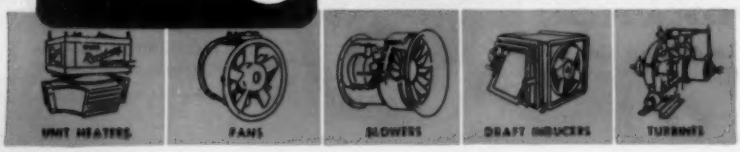

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Only *Heating, Piping & Air Conditioning* magazine adequately covers all three fields each issue. Best evidence is last year's record:

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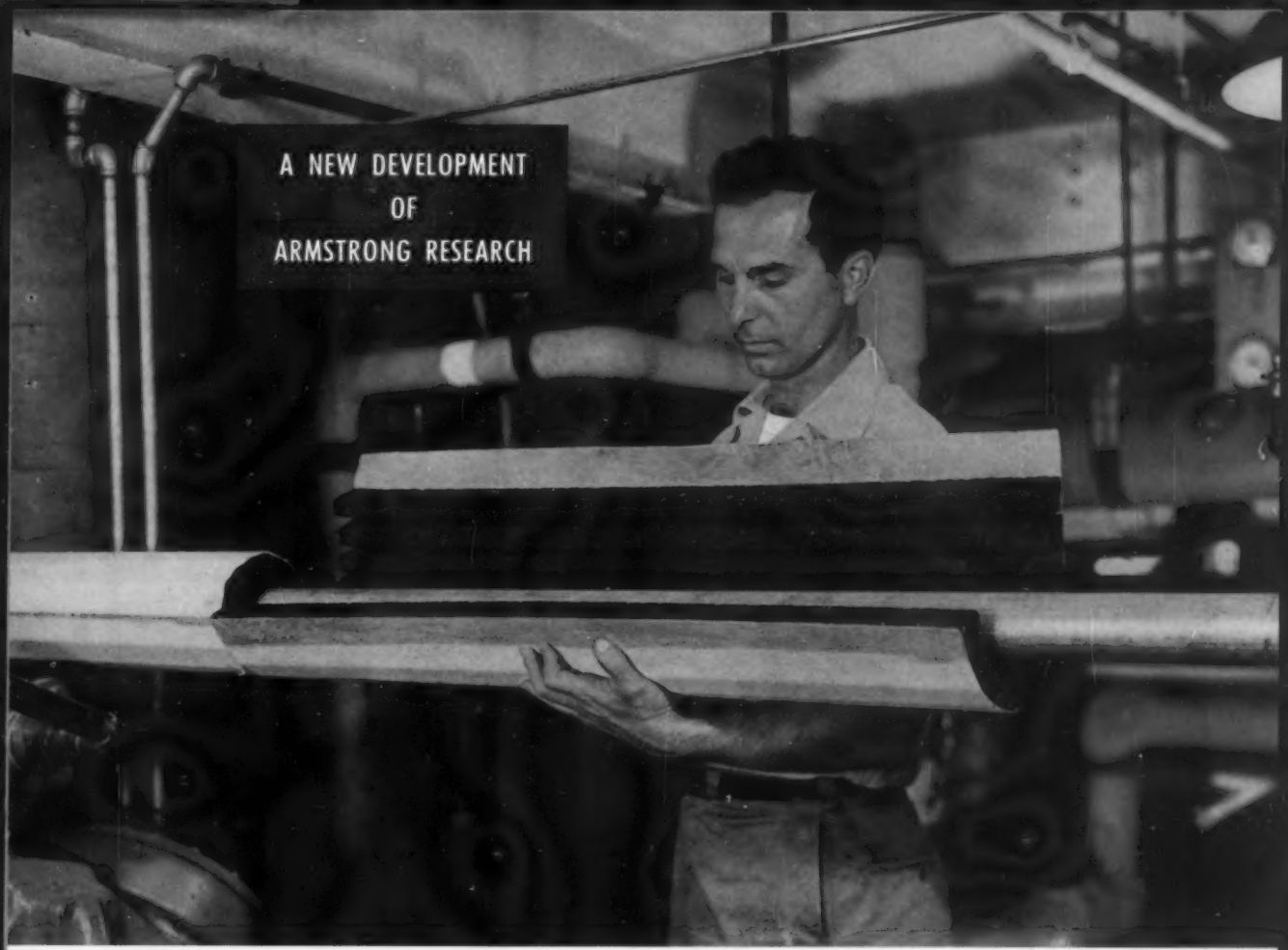


LT Cork Coverings . . . *low-cost, easy-to-apply insulations for low-temperature lines*

This complete new line of economical cork pipe covering is designed to prevent condensation on lines operating at temperatures to 30° below zero. Available in three types—LT-Thirty, LT-Zero, and LT-Minus Thirty—these coverings offer the same high insulating efficiencies and long life as molded cork coverings, yet cost much less for materials and installation.

LT Cork Coverings are fabricated from precision-cut sections of Armstrong Corkboard bonded to a fire-resistant, asbestos and aluminum foil jacket. The aluminum foil acts as a built-in vapor barrier. The white jacket presents a trim appearance that usually requires no further finishing.

Installation of LT Cork Coverings is fast and easy. Simply apply Armstrong 520 Adhesive to a special overlap on the covering, fit the covering tightly around the pipe, and press the lap firmly in place. Butt joints are sealed quickly with a self-adhering white vapor-barrier tape.

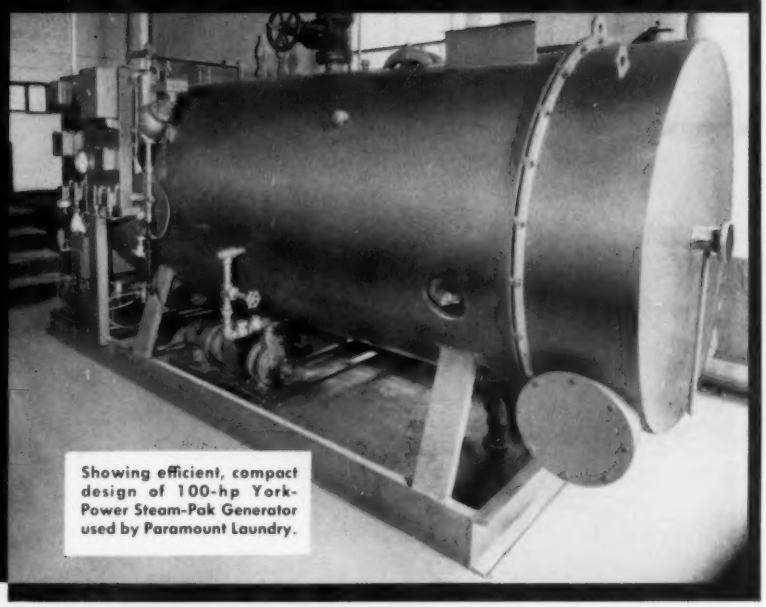
The development of LT Cork Coverings is another example of how Armstrong continues to work to improve industrial insulation materials and methods. For descriptive booklets on the entire Armstrong line of industrial insulations and Complete Contract Service, call your nearest Armstrong office or write Armstrong Cork Company, 2010 Stratton St., Lancaster, Pa.

LT-Thirty Cork Covering prevents sweating under normal conditions at line temperatures of 30° F. or above. LT-Zero is suitable at temperatures down to 0° F.; LT-Minus Thirty at temperatures to −30° F.

Armstrong INDUSTRIAL INSULATIONS

THEY CUT FUEL COSTS 48%!

"Fantastic savings" reported by Lowell, Mass. company with YORK-POWER 100-hp packaged steam generator.



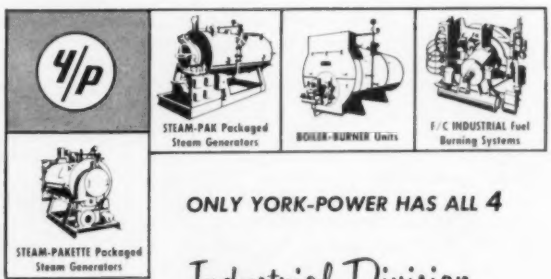
Showing efficient, compact design of 100-hp York-Power Steam-Pak Generator used by Paramount Laundry.

A careful comparison of fuel savings over a 6-month period, after installation of a York-Power high-pressure 100-hp. packaged steam generator, revealed a fuel saving of 48% over previous equipment, for the Paramount Cleansers and Launderers of Lowell, Mass.

"This figure seems hard to believe," writes Owner Charles A. Hatem. "Much of the savings," he states, "comes from the fact that this York-Power unit (Steam-Pak Model SPH-100-N5) burns cheaper No. 5 oil as well as gas, instead of No. 2 oil. During the period when the demand for gas is heavy, we burn oil, thus assuring ourselves of minimum fuel bills."

Reduces heat losses, too!

This versatile York-Power generator supplies steam for both dry cleansing and for the laundry room. It also heats the entire plant. And, the modern Steam-Pak design holds heat losses, at the unit itself, *very close to zero.*



ONLY YORK-POWER HAS ALL 4

Find out how York-Power units can improve the service and the savings of your plant! For further information call your York-Power Representative, or write for detailed data sheets TODAY!

Industrial Division

YORK-SHIPLEY, INC.

YORK, PENNSYLVANIA

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UNIFORM COMFORT under all weather conditions is of first importance to a library.

Sarcotherm heating controls, ventilating controls and specialties have been installed during the last two years in ten libraries, designed and constructed under supervision of the New York City Department of Public Works.

Sarcotherm controls are extremely accurate, sensitive and dependable. They provide trouble-free performance, promote economical operation and contribute to enthusiastic user satisfaction.

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AN AFFILIATE OF *SARCO COMPANY, INC.*

Weather-Compensated Controls for steam, hot water and radiant Heating

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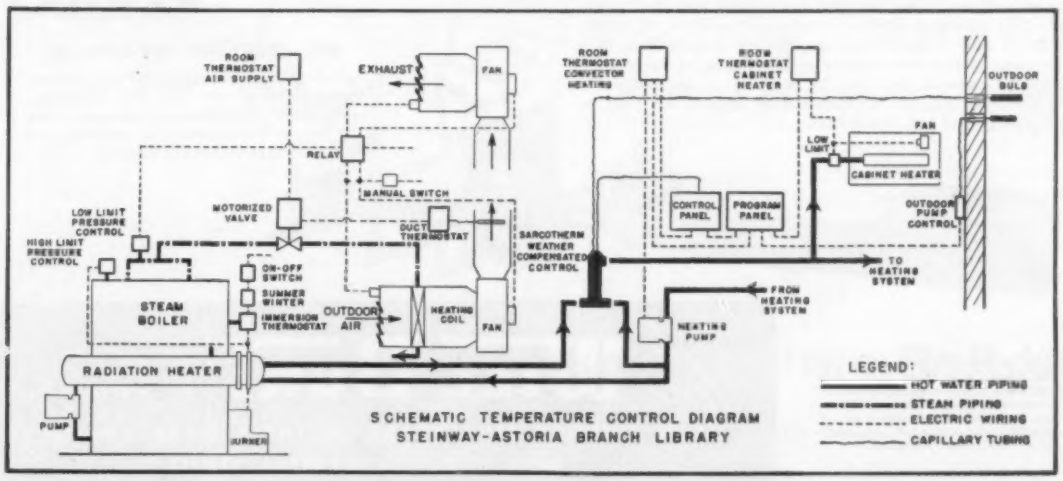


Architect: Adolph Goldberg, Brooklyn, N. Y. Engineers: V. L. Falotico & Associates, Brooklyn, N. Y. Heating Contractor: H. Sand & Co., New York, N. Y.

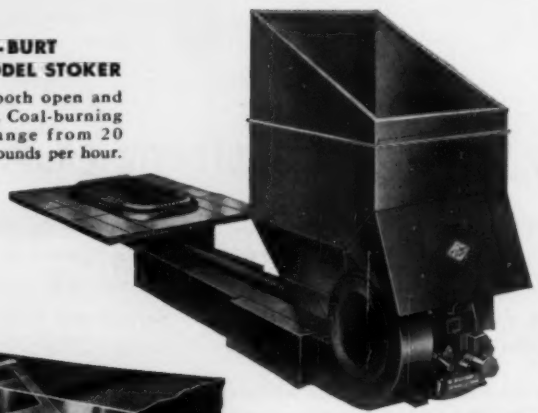
SAFE, CLEAN COAL HEAT

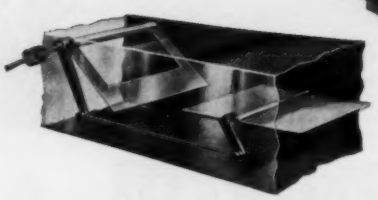
ENGINEERED FOR LOW COST TROUBLE-FREE OPERATION & MAINTENANCE—

Coal fired with a Will-Burt Stoker is the preferred method of heating wherever low-cost installation, clean coal heat and a factor of greater safety are of utmost importance. Will-Burt Stokers are engineered for application to a variety of coal burning boilers and furnaces, providing trouble-free performance, particularly where installations in schools, hospitals, churches, institutions, apartments and factory buildings require relief from maintenance throughout the heating seasons. The Will-Burt patented automatic air control delivers the correct quantities of air for complete efficient combustion during the operating and off periods—providing low-cost, clean coal heat. Prevention of smoke and soot, such as is usually prevalent when the fire is starved for air, is practically eliminated by air automatically induced to meet ever-changing fuel bed conditions.

WILL-BURT HOPPER MODEL STOKER

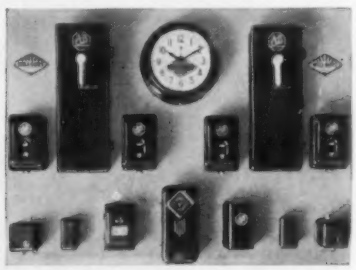
available in both open and closed hoppers. Coal-burning capacities range from 20 through 750 pounds per hour.





WILL-BURT AUTOMATIC AIR CONTROL

assures the proper combustion of fuel during the operating period as well as during the time the blower and feed screw are off. This patented device prevents a condition of smoke and soot. It allows for dissipation of any intense heat that may be surrounding the tuyeres or dead plate by permitting induction of normal draft to the fire bed. It automatically assures the most efficient combustion of bituminous coal in ever-changing fuel bed conditions.



WILL-BURT CONTROL PANEL

Prewired, pretested control panel boards provide an interconnected control system for stokers to be operated by either a common operating and/or individual holdfire control, depending on the setting of the safety switch, off-on switch and timeswitch cycle. Mounting wall brackets are provided.

ALL THESE ADVANTAGES WITH A WILL-BURT STOKER

WILL-BURT BIN FED STOKERS

reduce cost of coal handling and maintenance to an all-time low. For application with various types of bituminous coal burning boilers and furnaces, in the same fuel capacity range as hopper models.

Write on your letterhead for the Will-Burt Stoker Data Book, complete with engineering information, dimension and installation drawings, suggested specifications, etc. A valuable reference book, especially for architects and engineers.

The WILL-BURT Company

OVER TWENTY-FIVE YEARS IN THE STOKER BUSINESS

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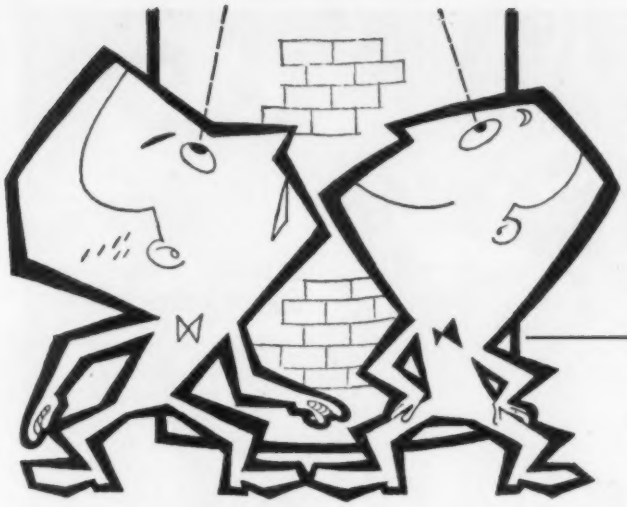


Your chimney never smokes any more. Did you change to another fuel?

We just changed to another kind of coal. And man! Does it make a difference! No smoke. No clinkers. No trouble. And very few ashes.

What kind of magic coal is this?

It's one of the superior quality coals produced on the Chesapeake and Ohio. But the important thing is that it is exactly right for our type of installation.

Say, I've got to look into this! We're always having boiler room trouble at our plant.

Picking the right coal is a job for an expert. I never realized there were so many things to consider. Size, moisture, sulphur, ash softening temperature, etc., as well as BTU's.

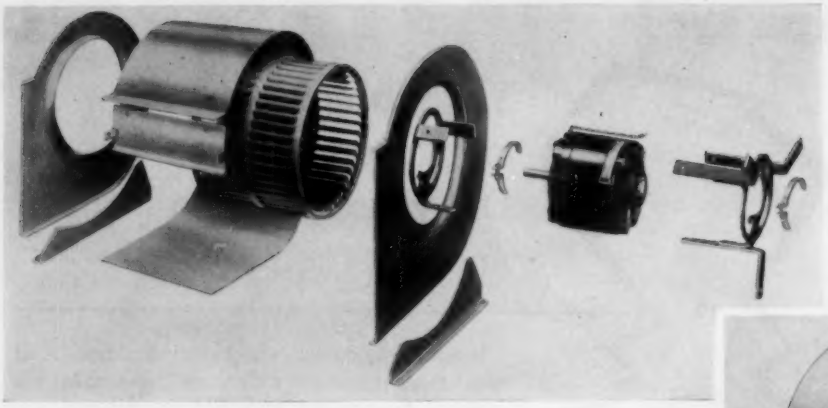
Why don't you write to the C&O coal people? Tell them your problem and describe your boiler equipment. They'll help you find the very best coal for your particular condition.

P.S.

There's a lot more to buying coal than the cost per ton. Why not contact coal producers on the C&O to solve your particular fuel requirements, or write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake and Ohio Railway Company, Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway

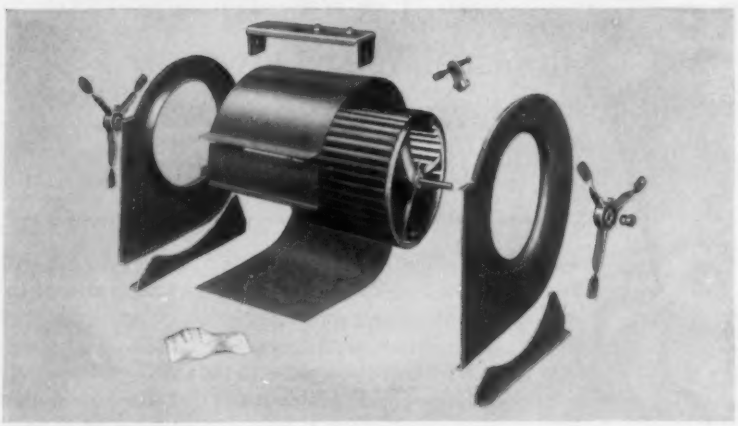
WORLD'S LARGEST CARRIER OF BITUMINOUS COAL



COMPACT • QUIET
DIRECT DRIVE BLOWER

Many Original Equipment Manufacturers *have found that they can save up to* 50% *of their Blower Dollar...*

BY BUILDING THEIR OWN BLOWER ASSEMBLIES*



Exploded view of belt driven blower, showing component parts.

Manufacturers of Original Equipment have found Morrison Blowers and Parts to be unsurpassed in design, construction and performance.

Write for Catalog 603

A sheet for each blower featuring:

- Performance curves and tables,
- Full dimensional data,
- Pulley size and belt length,
- Explosion view of component parts

We're going! Are you?
42nd ANNUAL CONVENTION
NATIONAL WARM AIR HEATING & AIR CONDITIONING ASSOCIATION
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*And be sure to ask about the 50% Saving

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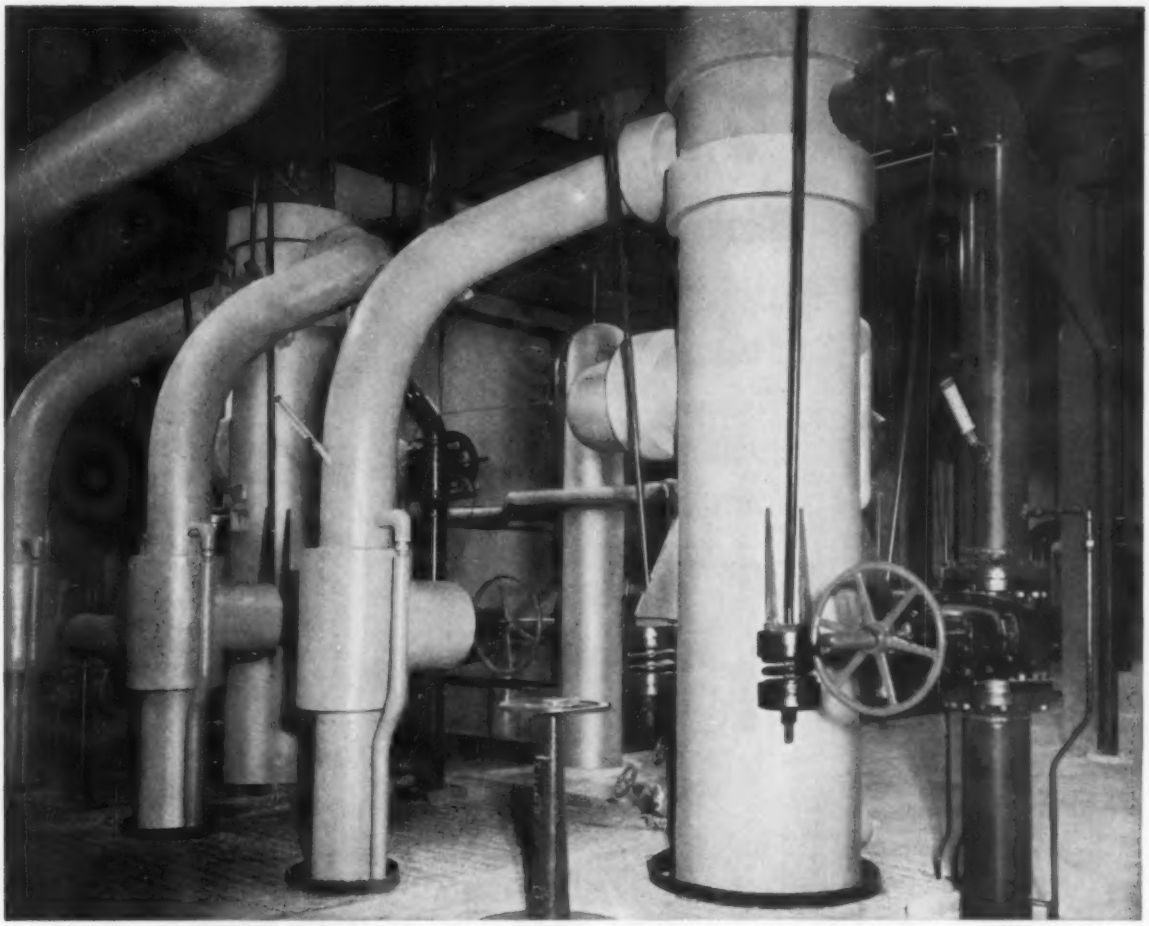

At this large southern power station, exhaust steam lines from turbines to stage heaters are insulated by a combination of K&M "Featherweight" 85% Magnesia and K&M Hy-Temp Insulations.

K&M HIGH PRESSURE INSULATIONS
save heat, cut costs

In plants of almost every type, the heat-saving efficiency of K&M High Pressure Insulations keeps steam losses down, shrinks operating costs. There's a complete K&M line to satisfy all heat insulation requirements—efficiently, economically.

For efficiency to 1900°F.—K&M Hy-Temp Insulation. It's made of diatomaceous silica combined with heat-resistant fillers and asbestos fiber. Usually applied together with K&M "Featherweight" 85% Magnesia.

For efficiency to 600°F.—K&M "Featherweight"® 85% Magnesia. Notably efficient in insulating piping and equipment at temperatures to 600°F. Composed of 85% basic carbonate of magnesia and asbestos fiber, K&M "Featherweight" withstands moisture, vibration, and frequent temperature changes.

Hy-Temp and "Featherweight" combined, and applied so that joints are staggered, eliminate the heat loss that normally occurs in single-layer installations—particularly when piping expansion causes insulation joints to open.

Where severe water exposure is a problem — K & M "Featherweight" Water-Resistant Magnesia is especially effective. Also recommended for applications where high humidity and moisture are present. It withstands temperatures to 450°F.

K&M High Pressure Insulations are sold through distributors who are experienced applicators. Contact your K&M distributor, or write directly to us, for further information.

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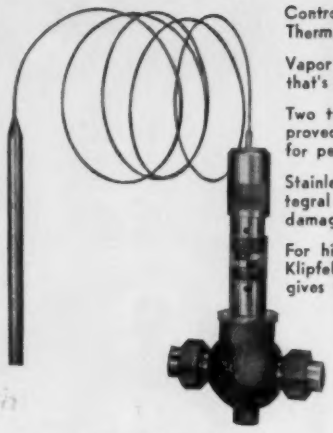
K&M best in asbestos®

CUT STEAM WASTE 2 WAYS with Klipfel THERMOSTATIC VALVES



Klipfel No. 1449
Temperature Control Valve

Control that's accurate plus positive tight closing make Klipfel Thermostatic Valves real steamsavers in operation.

Vapor pressure operated, these tank thermostats give control that's dependably sure . . . always.

Two types of single seated inner valves — both successfully proved on Klipfel's pressure reducing valves — are available for permanent tight closing:

Stainless steel ball inner valve and seat pushing with integral guides stops steam leakage, prevents wasteful, damaging overheating.

For high pressure applications and in larger sizes, Klipfel's pilot balanced, cup disc type inner valve gives the same advantage of dead end closing.

For complete details, write Dept. B-10 for Bulletin 354.

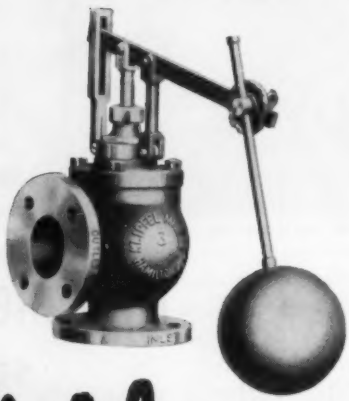
Float Valves, Reducing Valves, Tank Thermostats, Back Pressure Valves.

Klipfel

Div. of Hamilton-Thomas Corp.
Hamilton, Ohio

Export Dept., 1010 Schaff Bldg.
Philadelphia, Pa.

TO KEEP LIQUIDS on-the-level



Klipfel Float Valves

• For liquid level control that's really automatic, depend on Klipfel Float Valves. They have a forty year record of dependability on thousands of installations, large and small, water and chemical, throughout the land.

• Available indirect acting or pilot control types, either single seated or double seated. Whatever your requirements of pressure, temperature, fluid and closure, there is a Klipfel Float Valve for the job.

• Also available with Klipfel's exclusive cup disc inner valve for tight control for liquids injurious to rubber and leather and for higher pressures.

• For complete details, write Dept. B-10 for Bulletin 346. Float Valves, Reducing Valves, Tank Thermostats, Back Pressure Valves.

Klipfel VALVES, INC.

Division of Hamilton-Thomas Corp.
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Cecil Young, Chief Engineer, The Peerless Electric Company, with Peerless motors in new NEMA frame sizes.

CAN YOU MATCH THIS?

Peerless is one of the few fan and blower manufacturers that builds its own motors. That's one reason why Peerless fans and blowers conform with all standards—PFMA, NAFM and NEMA. What's more, because we build our own motors, we can match them to fans and blowers for peak performance.

We select motor characteristics which give best results. This versatility permits us to equip our fans and blowers with special motors—custom-built for the jobs they must perform—moving dirty, grit-laden foundry air; working in high heats in electronic cabinets; operating safely in hazardous locations where non-explosive qualities are needed; and operating without failure where uninterrupted service is a must.

Premium-built Peerless motors power famous OEM products in all fields and are the choice of those manufacturers who insist on specials rather than repetitive models. Is it any wonder that Peerless Electric fans and blowers hit such high performance levels.

Select the fans and blowers that meet all industry codes—Peerless. Check the Peerless bulletins. SDA-160 shows performance data on all fans and forward curve blowers. SDA-200 gives complete data on backward curve blowers. Use the coupon below to get your file copy. Dimension prints available on request.

FAN AND BLOWER DIVISION

Peerless Electric **THE PEERLESS ELECTRIC COMPANY**

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FANS • BLOWERS • MOTORS • ELECTRONIC EQUIPMENT

THE PEERLESS ELECTRIC CO.
WARREN, OHIO

☐ Send me Bulletin SDA-160.
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NAME .....
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Every inch of Floor and Wall Space is usable . . .

A typical radiant heated suburban development home.

Typical installation of steel pipe radiant heating coils on slab.

with "invisible" radiant panel heating

As the song says, "little things mean a lot" . . . to a woman.

She chooses an automobile by its color, selects a television set for its cabinet . . . and may insist on a radiant panel heating system solely because it gives her *complete* freedom of decoration in her home. The *only* heating system that does, because every inch of floor and wall space remains *usable*. Why should a mere man object to her whims as long as there's horsepower under the hood, a clear picture from the T.V. set, and the heating system gives clean, healthful, draft-free comfort!

It *is* a fact that *women* have helped make radiant panel heating increasingly popular for individual homes, multiple dwellings and housing developments . . . up significantly last year among wet heat installations.

And, as in other wet heat systems, the *men* who design, specify and install, know that reliable steel pipe is first choice for heat transmission. Time tested through more than 60 years of hot water and steam applications, it also has the qualities of economy, durability, weldability and formability required for successful "invisible" radiant panel heating. In fact it's the most widely used pipe in the world!

Write for the free 48 page color booklet "Radiant Panel Heating with Steel Pipe" and 32 page companion booklet "Steel Pipe Snow Melting and Ice Removal Systems."

Steel Pipe is First Choice

Committee on
STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 FIFTH AVENUE, NEW YORK 1, N.Y.

THE *NEW* FLEXON HIGH-PRESSURE COMPENSATOR*

the first truly satisfactory answer to the problem of expansion control in steam heating systems.

Flexonics Corporation
1391 S. Third Ave.
Maywood, Illinois

Please send Bulletin 151 giving detailed information and specifications for the new FLEXON Model H High Pressure Compensator.

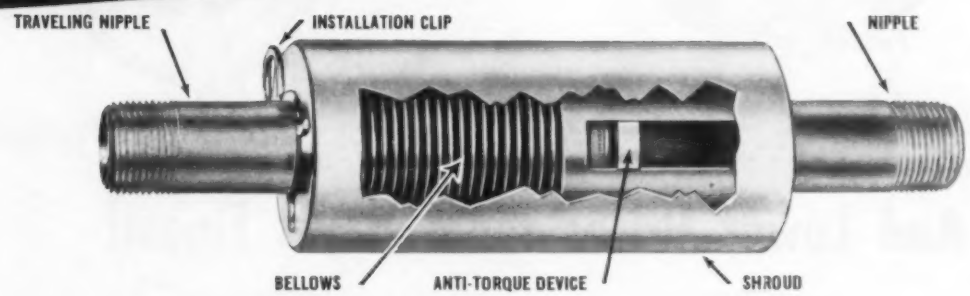
Name_____ Title_____

Company_____

Street_____

City_____ Zone___ State_____

Here's the ticket
to maintenance—free expansion control



ONLY THE FLEXON COMPENSATOR GIVES YOU ALL THESE ADVANTAGES

- **LIGHT WEIGHT**—Only a fraction of that of other units.
- **COMPACT**—Up to ⅓ shorter and ¼ to ½ smaller in O.D. Saves valuable building space.
- **MAINTENANCE-FREE**—Install it and forget it. It's good for the life of the system.
- **PRECISION MADE** by the pioneers of stainless steel bellows and experienced manufacturers of steam specialties.

TYPICAL SPECIFICATIONS

The specifications for the 1" Model H FLEXON Expansion Compensator are given below. Other sizes are comparable.

PIPE SIZE	OVERALL LENGTH	MAXIMUM O.D.	WORKING PRESSURE	WEIGHT LBS.
1"	9⅛"	2⅜"	150	2.8

**Patents Pending*

With the new Flexon High Pressure Compensator*, control of expansion in heat risers becomes practical, efficient and economical. Here is a unit, proved in field applications, that is lighter in weight, more compact and completely maintenance-free.

As the cut-away above shows, the Flexon Compensator is fabricated from all-welded steel plate. There are no cumbersome space-consuming castings. The stainless steel bellows is completely guided internally and is externally restrained. The unit is provided with a positive anti-torque device to prevent possible bellows damage during installation.

All sizes of the Flexon High Pressure Compensator handle 1½" motion and may be used at temperatures to 750° F. Male NPT nipples are standard; ground joint unions or welding ends are optional.

Don't delay! Use the coupon above to get full information on this revolutionary piping advancement.

EC-11

Flexonics Corporation EXPANSION JOINT DIVISION
1391 S. THIRD AVENUE · MAYWOOD, ILLINOIS

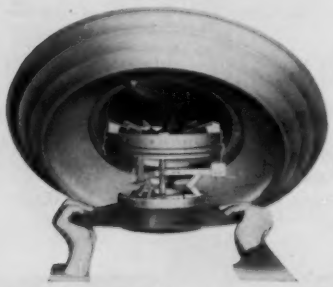
FORMERLY CHICAGO METAL HOSE CORPORATION
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies products of Flexonics Corporation that have served industry for over 53 years.

ONLY CARNES DIFFUSERS GIVE YOU THESE

OUTSTANDING FEATURES!

1 Easy Installation



Just 3 simple steps to install Carnes diffusers: (1) Remove center cone and adapter assembly (no tools needed); (2) Fasten ceiling plate to duct work with sheet metal screws; (3) Replace center cone and damper assembly.

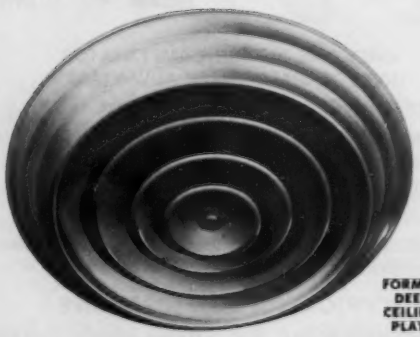
2 Fast, Easy Balancing and Adjusting

Both pattern and volume is easily accomplished from the face of the diffuser—without tools. Any pattern from horizontal to vertical is simply obtained.

3 And Lower Prices for Today's Finest!

FORM 1 STANDARD CEILING PLATE

Beautifully styled Model E (fixed cone) and Model EJ (fully adjustable) with standard ceiling plate. Can be mounted on duct work or flush to ceiling. A full range of sizes is available.



FORM 2 DEEP CEILING PLATE

Models E and EJ with deep ceiling plate that prevents ceiling aging and eliminates anti-smudge rings. A complete range of sizes available . . . all fully adjustable for air pattern.

Carnes diffusers appeal to architects for their modern, streamlined appearance; to engineers for their performance and simple balancing; to contractors for their easy installation and low price. You'll be ahead all ways . . . with Carnes!

CARNES CORP.

VERONA, WISCONSIN

PROMPT DELIVERY

Warehouses in all parts of the country assure prompt, out-of-stock shipment of all Carnes products.

Brundage . . . blowers since 1919

Customers say it so much better

"For the past six years I have been dealing with various manufacturers and suppliers and I can truthfully say that I have never had such co-operation and genuine desire to give the very best of service as I have enjoyed from your company personnel."

— — —

After 36 years in the blower business, we are expected to provide the best in air handling equipment. But, it's service to every customer, large or small, that keeps us growing.

That's why we appreciate hearing things like this from our customers. It lets us know that Brundage service is up to the standards we strive for.

We'd like an opportunity to serve you in the same way.

THE Brundage COMPANY

512 N. PARK ST. KALAMAZOO, MICH.

PHONE 2-0251

BEFORE YOU BUY A PACKAGE BOILER

CHECK THIS LIST!

If you need a package boiler, the list at the right can give you some interesting answers. Of course, C-E's Type VP Boiler rates a "yes" answer to every question. It offers also many other operational advantages, such as simple, effective soot blowing; high heat absorption; low draft loss, no dead gas pockets and simple baffle arrangements.

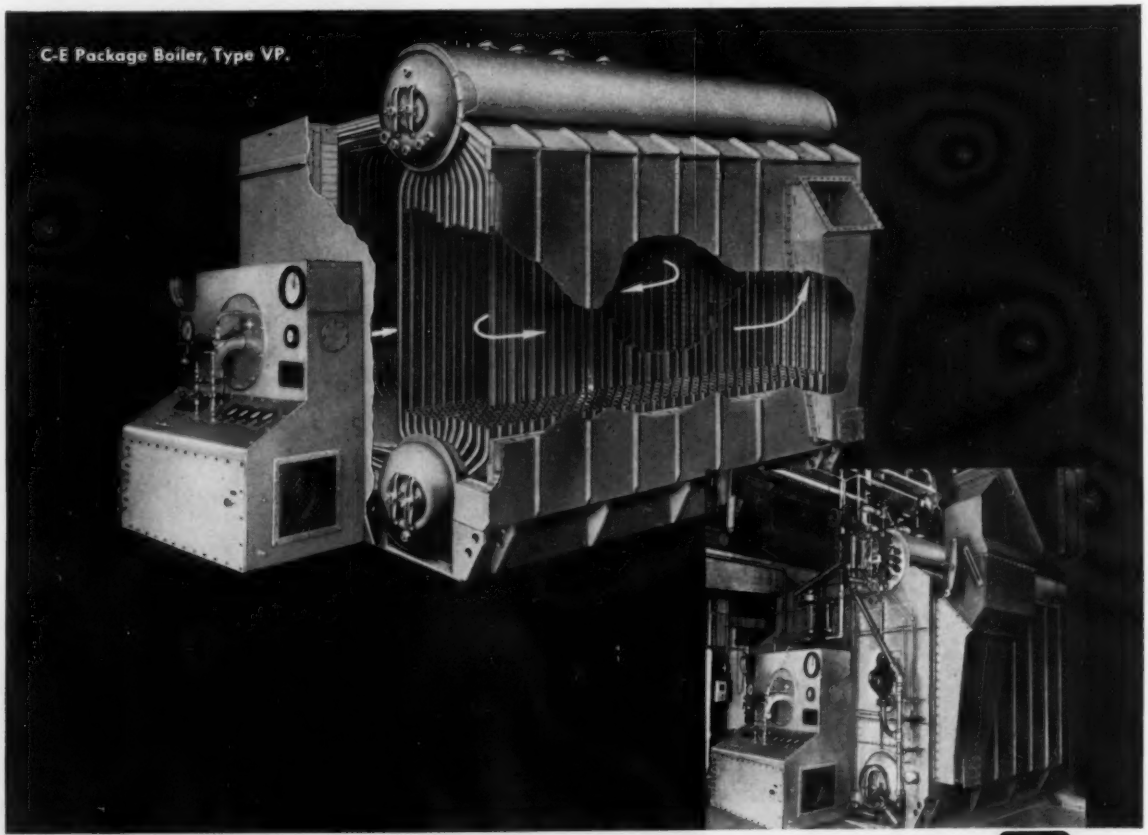
That's why VP purchasers range from small companies to some of the nation's largest – plus schools, institutions, government agencies, including the Atomic Energy Commission. These users employ VP Boilers for all types of applications – heating, process, even power generation.

SPECIFICATIONS OF THE VP BOILER

Capacity – 4,000 to 40,000 pounds of steam per hour
Pressures – up to 500 pounds per square inch
Fuel – oil or gas
Erection – completely shop-assembled
Foundation – simple concrete slab

Have full details on the VP next time you are in the market for a boiler of moderate capacity. Get the new Catalog VP-177, which contains specifications, and information on dimensions, construction details and controls. B-8458

	BOILER A		BOILER B		BOILER C	
	Yes	No	Yes	No	Yes	No
Will your boiler be a real "package" type with control panel and all controls mounted integral with the boiler?						
Will your package boiler be equipped with drum internals to assure dry steam?						
Will its "steam quality" be backed with a guarantee?						
Will your boiler have a 30-in. lower drum to provide convenient accessibility?						
Will yours be a one-burner boiler, with a simple wiring and control system?						
Will your boiler have the largest load swing range available?						
Will your boiler be equipped with a quiet centrifugal fan?						
Will your furnace be *completely* water-cooled?						
Will your furnace have the highest ratio of water cooled surface to furnace volume?						

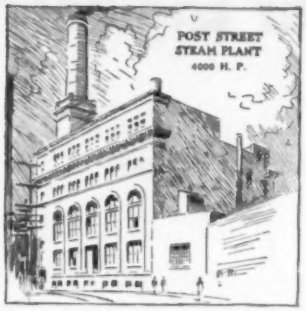


C-E Package Boiler, Type VP.

COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

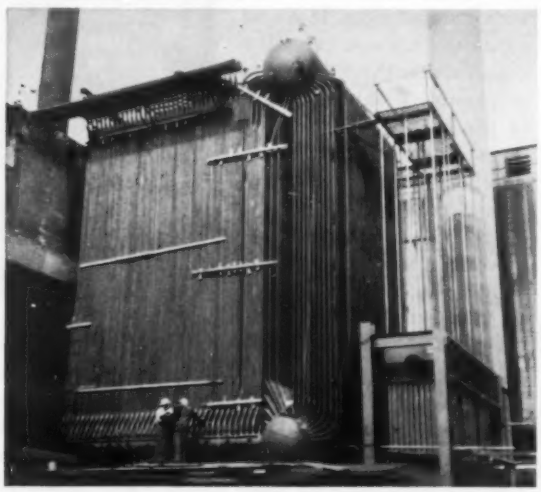
BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS AND FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE



GILSULATE®— The End of A Search

Old Post St. plant has 4,000 HP boiler capacity. Steam lines were originally encased in red cedarwood log conduits.

New Riley Boiler of Seattle Steam Corp. at their Western Ave. plant has 266,000 pounds per hour peak load; is set in weatherproof casing.

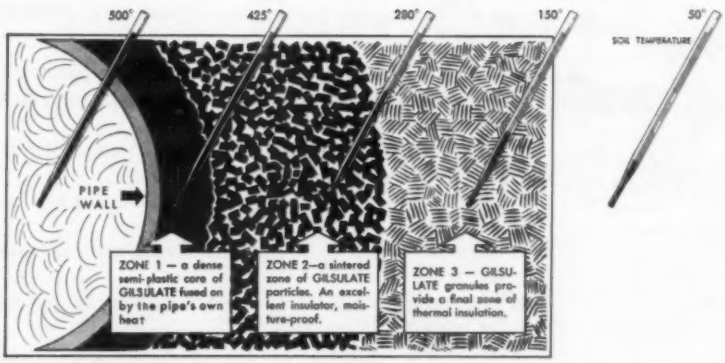


For more than half of a century, District Heating Companies have been seeking a way to prevent corrosion and reduce heat loss from underground steam mains. Many materials and techniques have been tried—unsuccessfully—spurred on by rising fuel prices and pipe replacement costs.

In 1952, Seattle Steam Corporation tried their first GILSULATE installation. So far, they have observed *complete corrosion protection and excellent insulating properties.* Is GILSULATE the end of the search?

Today this 18th largest of all American District Heating Companies orders GILSULATE in carload lots and maintains warehouse stocks for use on new lines, extensions and where a ditch is opened and existing facilities are exposed.

Investigate the values of this easily-installed, low-cost insulation yourself. Use the coupon below for complete information or write for the name of your nearest GILSULATE distributor.


500°
425°
280°
150°
PIPE WALL
ZONE 1 — a dense semi-plastic core of GILSULATE fused on by the pipe's own heat
ZONE 2—a sintered zone of GILSULATE particles. An excellent insulator, moisture-proof.
ZONE 3 — GILSULATE granules provide a final zone of thermal insulation.

Facts about Gilsulate

1. *Easy to use*—just pour, tamp and backfill…pipe heat does the rest.
2. *Forms 3 zones* of protection against heat loss and all hazards commonly encountered by hot buried pipes.
3. *Needs no housing or mechanical sheaths:* no mixing, special handling or equipment.
4. *Only needs normal pipe spacing:* for multiple pipe or cramped conditions.
5. *Three types available:*
   Type A for 220°-310° F. temp. range
   Type B for 300°-385° F. temp. range
   Type C for 385°-520° F. temp. range

THE TRIPLE-ZONE INSULATION FOR LIFETIME PROTECTION OF HOT UNDERGROUND PIPES

GILSULATE®

AMERICAN GILSONITE COMPANY, SALT LAKE CITY 1, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of California

American Gilsonite Co.
134-B West Broadway, Salt Lake City 1, Utah — or — 1145 East Jersey St., Elizabeth, N. J.

Send me more information on GILSULATE Insulation

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

HPA

Random Thoughts from a Filter Engineer

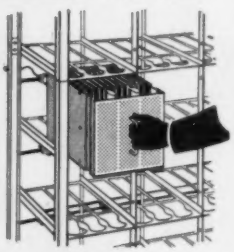
by Charles Meyer

- **HOW DO YOU FIGURE THE COST OF ELECTRONIC FILTERS?**
- **HOW TO IMPROVE ON A VOLTMETER**
- **EXTRAS THAT ADD UP TO A LOT**

HOW DO YOU FIGURE THE COST OF ELECTRONIC FILTERS?

If you just look at the delivered net price, you're overlooking an important fact. The total price must include the erection or installation cost and the owner pays for this, whether or not he realizes it.

Take the case of our Electromaze—the electronic filter that removes dirt particles down to 1/50 of a micron. The unit selling price won't stampede purchasing agents because it is comparable with other makes. But if these purchasing agents figure the cost of installation, they'll find a big saving—as much as one-half the cost of installing other types. That's because of the special "building block" design of the Electromaze. Each cell is a complete, self-contained electric filter. There are no separate hinges or ionizing sections to install. Each section of cells is quickly attached to other sections so the complete job is finished in a hurry. And because these sections are lighter, they are easier to handle and with less chance of damage.



Electromaze

So when you figure the cost of an electronic filter, make sure you add installation costs to the delivered net price. Then you'll have the *true* cost of the filter.

HOW TO IMPROVE ON A VOLTMETER

Almost everyone wants equipment that's easy to use. That goes for the manufacturer as well as the customer. A good example of this trend toward simplicity is the Cadillac. Some years ago it had a voltmeter to indicate if the generator was charging the battery. Now it has a red light which glows if the generator is *not* charging.

We accomplished a similar feat with our Electromaze. It doesn't have a voltmeter, either. Because we've found a simpler way to tell a maintenance man if the equipment is operating properly.

We've replaced the voltmeter with a signal light. If it's on, a maintenance man can tell at a glance that the Electromaze is operating within safe limits. If it's off, he immediately knows something is wrong. Think how much simpler this is than looking at a meter and interpreting the readings. And how much less chance there is of mistakes.

EXTRAS THAT ADD UP TO A LOT

Most of the well-known electronic air cleaners are similar in principle. And all of them have the same function—to remove the finest particles of dust. They're even priced about the same. To find out which gives you the most value, it pays you to look beyond the surface for the little extras that can mean a lot.

Our Electromaze has extra engineering features including:

1. Selenium type rectifier to eliminate tube replacement
2. Silicone coated insulators that repel moisture, help prevent shorts
3. Etched aluminum plate that provides a better surface for retention of adhesive
4. Iridyte-coated cells for extra protection against corrosion
5. Built-in diffuser plate in front of each cell for better air distribution
6. Integral ionizing wire and bracket assembly that can be replaced in seconds.

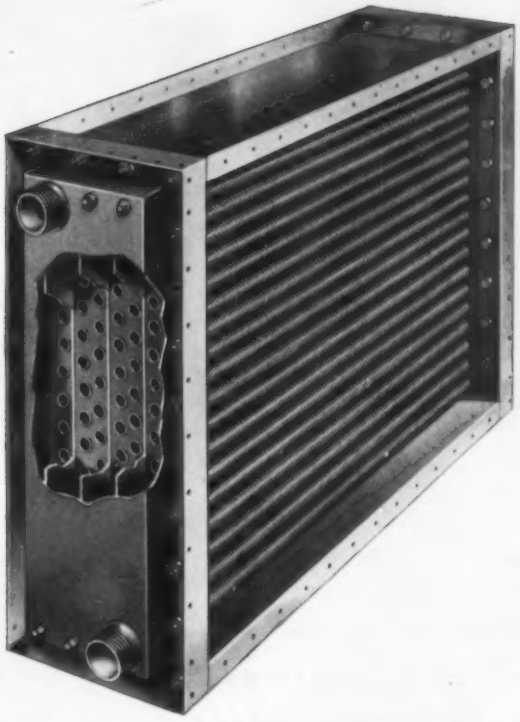
Any one of these extras taken separately is important. When you put all of them together, they add up to a big plus value for Electromaze. The Air-Maze Corp., 25000 Miles Road, Cleveland 28, Ohio.

AFI MEMBER AIR FILTER INSTITUTE

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS



AEROFIN TYPE R REMOVABLE-HEADER WATER COILS

• Complete Drainability
• Easily Cleaned
• High Heat Transfer

Completely drainable and easily cleaned, Aerofin Type "R" coils are specially designed for installations where frequent mechanical cleaning of the inside of the tubes is required.

The use of ⅝" O. D. tubes permits the coil to drain completely through the water and drain connections and, in installations where sediment is a problem, the coil can be pitched in either direction. The simple removal of a single gasketed plate at each end of the coil exposes every tube, and makes thorough cleaning possible from either end.

The finned tubes are staggered in the direction of air flow, resulting in maximum heat transfer. Casings are standardized for easy installation.

Write for Bulletin No. R-50.

AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N. Y.

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

Where to Get
ARMCO STAINLESS STEELS
in a Hurry

When you need quick delivery of stainless steel sheets and strip, remember this: An Armco Distributor's warehouse is close-by. A phone call is all that's required.

You'll find that Armco Stainless Distributors know their business. All have mill-trained salesmen who will be glad to work with you in selecting the right grade. They have the latest Armco literature and fabricating information. It's available to you for the asking.

Look over this list of Armco Stainless Steel Distributors. There's probably one in your own "back yard." Keep him in mind the next time you need stainless.

Armco Stainless Steel Sheet and Strip Distributors

CALIFORNIA
Bakersfield
Tay-Holbrook, Inc.
Berkeley
Tay-Holbrook, Inc.
Emeryville
Electric Steel Foundry Co.
Eureka
Tay-Holbrook, Inc.
Fresno
Tay-Holbrook, Inc.
Los Angeles
The Cold Metal Products Co. of California
Electric Steel Foundry Co.
Oakland
Tay-Holbrook, Inc.
Sacramento
Tay-Holbrook, Inc.
Salinas
Tay-Holbrook, Inc.
San Carlos
Tay-Holbrook, Inc.
San Francisco
Tay-Holbrook, Inc.
San Jose
Tay-Holbrook, Inc.
Santa Rosa
Tay-Holbrook, Inc.
Stockton
Tay-Holbrook, Inc.

COLORADO
Denver
C. A. Crosta, Inc.
Metal Goods Corp.

CONNECTICUT
Hartford
The American Steel & Aluminum Corp.
Herrick Company
Peter A. Frasse & Co., Inc.

FLORIDA
Jacksonville
Horne-Wilson, Inc.
Miami
Horne-Wilson, Inc.
Orlando
Horne-Wilson, Inc.
Tampa
Horne-Wilson, Inc.

GEORGIA
Atlanta
Horne-Wilson, Inc.
J. M. Tull Metal & Supply Co.

ILLINOIS
Chicago
Central Steel & Wire Co.

INDIANA
Hammond
W. J. Holliday & Co.
Div. of Jones & Laughlin Steel Co.
Indianapolis
W. J. Holliday & Co.
Div. of Jones & Laughlin Steel Co.

KANSAS
Wichita
Metal Goods Corp.

KENTUCKY
Louisville
Conner Mfg. Co.

LOUISIANA
New Orleans
Metal Goods Corp.
The Orleans Steel Products Co., Inc.

MAINE
Auburn
Brown-Wales Company
Lewiston
Herrick Company

MASSACHUSETTS
Cambridge
Brown-Wales Company
Fall River
Congdon & Carpenter Co.
South Boston
Herrick Company
Springfield
Warren F. Hoye, Inc.

MICHIGAN
Dearborn
Semmler Wholesale Supply Co.
Detroit
Central Steel & Wire Co.
Semmler Wholesale Supply Co.
Grand Rapids
The Behler-Young Company
Saginaw
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MISSOURI
Kansas City
Richards & Conover Steel Div.
North Kansas City
Metal Goods Corp.
St. Louis
Metal Goods Corp.
E. E. Souther Iron Co.

NEBRASKA
Omaha
Gate City Steel Works, Inc.

NEW YORK
Buffalo
Peter A. Frasse & Co., Inc.
Rochester
Follansbee Metals Corp.
Syracuse
Peter A. Frasse & Co., Inc.

METROPOLITAN NEW YORK
New York City
Peter A. Frasse & Co., Inc.
Hillside, N. J.
Edgcomb Steel & Aluminum Corp.
Lyndhurst, N. J.
Peter A. Frasse & Co., Inc.
Union, N. J.
Mapes & Sprowl Steel Co.

NORTH CAROLINA
Charlotte
Edgcomb Steel Company
Horne-Wilson, Inc.

OHIO
Cincinnati
Central Steel & Wire Co.
Cleveland
Viking Steel Co.
Columbus
Vorys Bros., Inc.
Toledo
C. F. Throm & Sons

OKLAHOMA
Tulsa
Metal Goods Corp.

OREGON
Portland
Electric Steel Foundry Co.

PENNSYLVANIA
Philadelphia
Edgcomb Steel Company
Peter A. Frasse & Co., Inc.
Pittsburgh
Follansbee Metals Corp.
York
Edgcomb Steel Company
York Corrugating Company

RHODE ISLAND
Providence
Congdon & Carpenter Company

TENNESSEE
Memphis
Metal Goods Corp.
Pidgeon-Thomas Iron Company

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Metal Goods Corp.
Moncrief-Lenoir Mfg. Co.
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Maxwell Steel Company
Harlingen
Moncrief-Lenoir Mfg. Co.
Houston
Metal Goods Corp.
Moncrief-Lenoir Mfg. Co.
Lubbock
Moncrief-Lenoir Mfg. Co.
San Antonio
Moncrief-Lenoir Mfg. Co.
Temple
Moncrief-Lenoir Mfg. Co.

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Burlington
Herrick Company

WASHINGTON
Seattle
Electric Steel Foundry Co.
Spokane
Electric Steel Foundry Co.

WASHINGTON, D. C.
York Corrugating Company

WISCONSIN
Milwaukee
Central Steel & Wire Co.

DOMINION OF CANADA
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Firth-Brown Steels, Ltd.
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ARMCO STEEL CORPORATION
1705 CURTIS STREET, MIDDLETOWN, OHIO

SPECIAL STEELS

Sheffield Steel Division • Armco Drainage & Metal Products, Inc. • The Armco International Corporation

Specify "TUBE-TURN" and you know you're right

THIS TUBE-TURN* Welding Return has a bursting strength at least equal to that calculated for the seamless pipe with which it is recommended for use. Made in U.S.A., it meets all American Standard and Safety Code requirements. Welders everywhere know it will line up perfectly . . . because it's forged by the only process that produces a wall with the maximum uniformity of thickness and circularity. In short, when you specify "TUBE-TURN" you *know* you're right.

Your nearby Tube Turns' Distributor is at your service. He can simplify your planning, meet your requirements exactly, with industry's most complete line of welding fittings and flanges.

TUBE-TURN Welding Fittings and Flanges are made in U.S.A.
They meet *all* U.S. piping code specifications.

*"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

TUBE TURNS

LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

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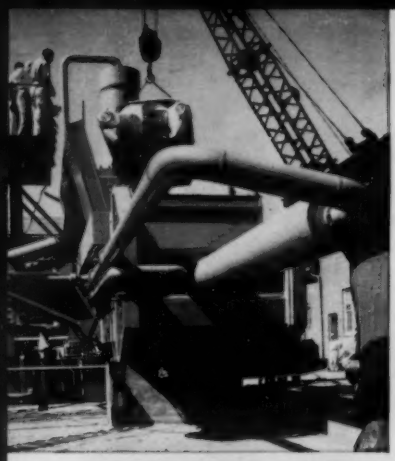
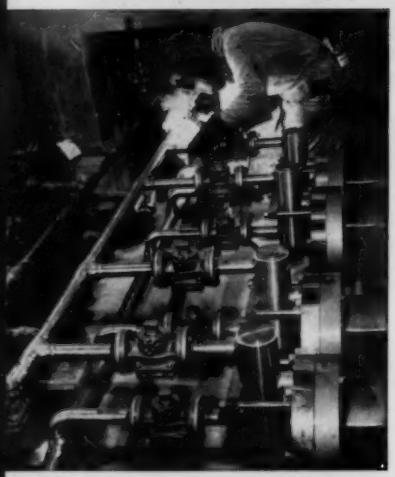
PIPING HELP





How TUBE TURNS' SERVICE can help simplify your piping jobs

1 ENGINEERING SERVICE

This unique press squeezes old automobiles into bales of metal to expedite scrap recovery. Designers of the press called on Tube Turns' Engineering Service for assistance in laying out the piping for the hydraulic system. Result—efficient, leakproof piping that enables the press to do its job on a two-minute cycle. Tube Turns' unmatched piping experience can help *you* when you have an out-of-the ordinary piping problem.

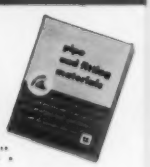
2 COMPLETE SELECTION

Here is a stainless steel nitric acid header using TUBE-TURN* Welding Fittings and Flanges for directional changes and valve connections. Stainless steel piping can provide long, safe service where corrosive gases or fluids are handled, or where temperature extremes are encountered. You can select TUBE-TURN Welding Fittings and Flanges in carbon steel, stainless steel, non ferrous metals and alloys, and in the schedules and sizes you need. Tube Turns offers industry's broadest line of welding fittings and flanges, covering over 4000 items.

3 FAST SERVICE

You expect a manufacturer to exercise strict quality control over his production—what about distribution of his products? Here again Tube Turns offers you outstanding service. Tube Turns selects *leading* distributors who maintain local stocks, are geared for fast service, and rate "A" for dependability. You can save purchasing time and inventory trouble when you work closely with your Tube Turns' Distributor. You'll find one in every principal city.

MATERIALS DATA . . . Tube Turns is recognized as a leading source of authoritative information on piping design. For booklet on "Pipe and Fittings Material", fill out and send the coupon now.



TUBE TURNS, Dept. A-5
224 East Broadway, Louisville 1, Kentucky
Please send bulletin on "Pipe and Fittings Material".

Company Name _____

Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____

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Philadelphia	Seattle
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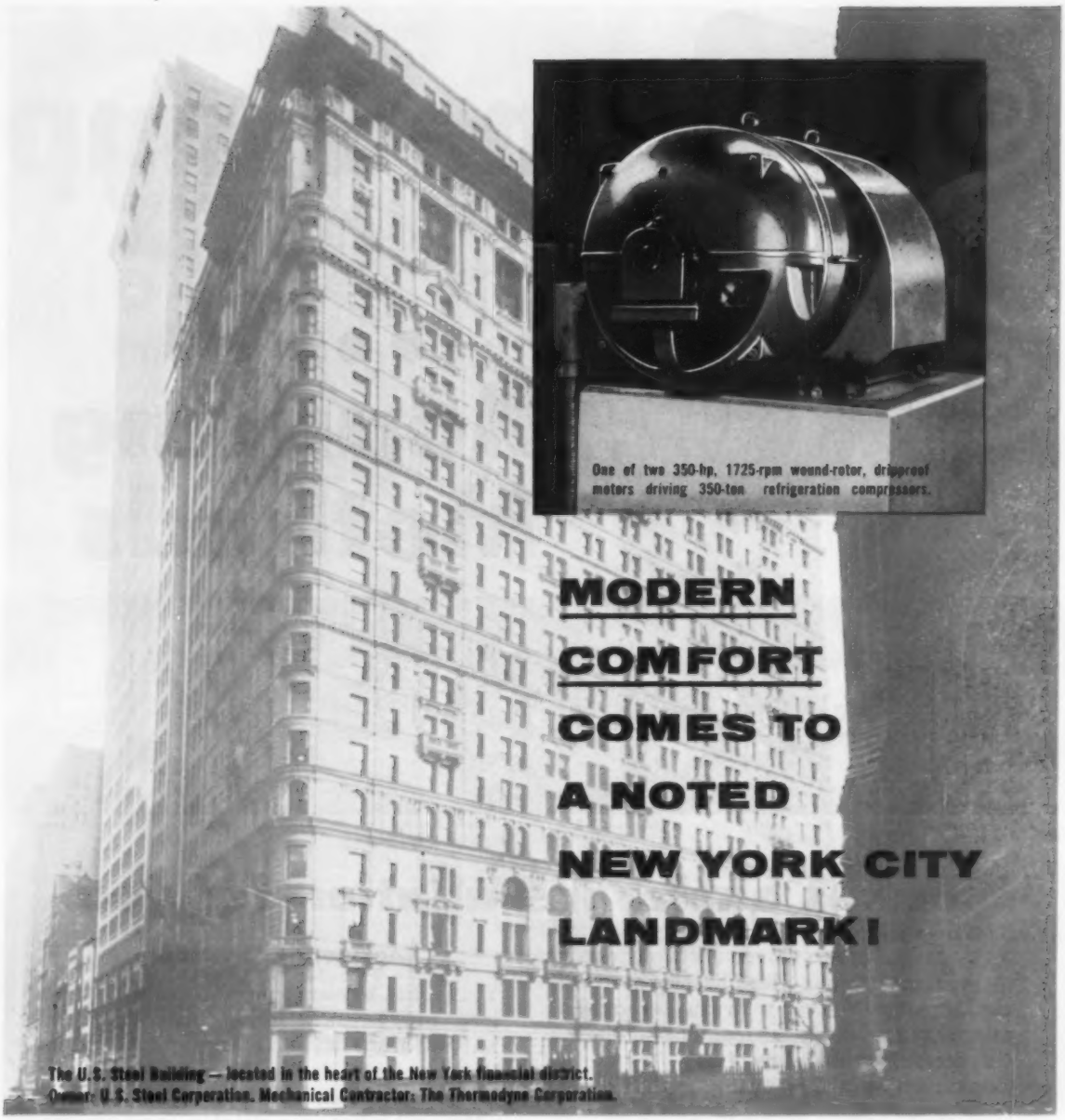
Detroit	Houston
Chicago	Kansas City
Denver	Dallas
Los Angeles	Midland, Texas

*"TUBE-TURN" and "tt" Reg. U. S. Pat. Off.

TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY


One of two 350-hp, 1725-rpm wound-rotor, dripproof motors driving 350-ton refrigeration compressors.
MODERN COMFORT COMES TO A NOTED NEW YORK CITY LANDMARK!
The U.S. Steel Building — located in the heart of the New York financial district.
Owner: U.S. Steel Corporation. Mechanical Contractor: The Thermodyne Corporation.

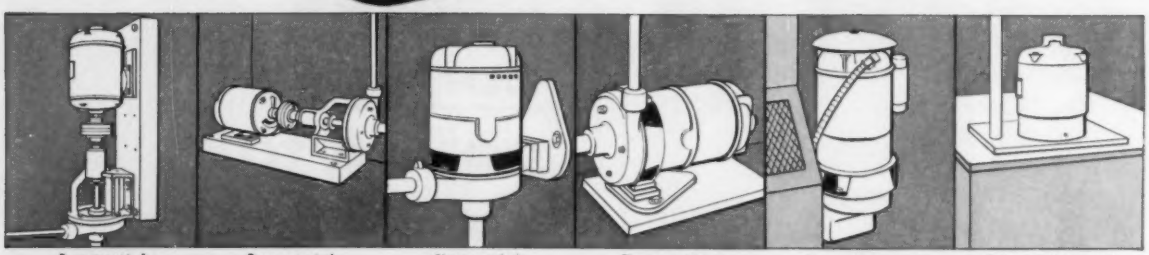
THE U. S. STEEL BUILDING—also known as Seventy-One Broadway, is familiar the world over as a New York City business address. Just recently, the 22-story, 58-year old building has been completely equipped with an efficient, up-to-date air conditioning system.

Approximately 55 to 60 Elliott Crocker-Wheeler motors, ranging in size from 3 to 350 hp, are installed throughout the system. They are driving various components such as compressors, condensers and chilled-water pumps, and cooling-tower fans. For additional information about Elliott Crocker-Wheeler motor applications in air conditioning systems, call your local Elliott representative or write Elliott Company, Crocker-Wheeler Division, Jeannette, Pa.

ELLIOTT Company

ALLIS-CHALMERS
Air Conditioning
PUMPS

One Pump ...6 Mounting Methods



Base mounted, vertical | Base mounted, horizontal | Close-coupled, vertically mounted | Close-coupled, horizontally mounted | Tank wall mounted | Submerged mounted

makes easier installation for you

YOU CAN SOLVE MANY DIFFICULT INSTALLATION problems by using Allis-Chalmers air conditioning pumps. You can get a single set of operating characteristics using four different models that can be installed in any of six different ways. You can choose the mounting method easiest for your job without having to figure a different pump each time.

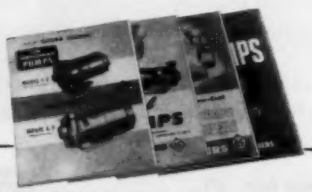
Engineering Assistance

Your Allis-Chalmers representative or distributor is an experienced, highly qualified specialist who will give you full cooperation every step of the way. He'll help you pre-engineer the setup. Many times he can make valuable suggestions which will result in a simpler, more effective installation.

Delivery from Convenient Stock

Allis-Chalmers air conditioning pumps in a wide range of types and sizes are carried in stock by Regional Warehouses and Authorized Distributors throughout the country. A-4577

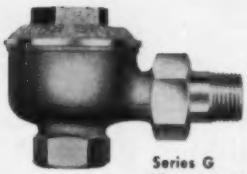
Electrifugal is an Allis-Chalmers trademark.



For literature on Allis-Chalmers Air Conditioning Pump (FHP) get Bulletin 5287529 . . . *Electrifugal* Pumps, Bulletin 5286083 . . . Small Vertical Pumps, Bulletin 5286975 . . . Base Mounted Pumps, 5286691. Write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

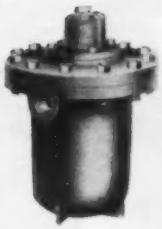
A-C ALLIS-CHALMERS

ALLIS-CHALMERS



Series G
Thermostatic Trap

Standard Pressure Range
15 pounds to 25 inches
vacuum

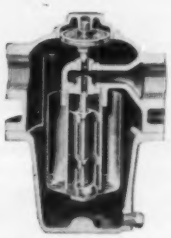


Series 45
Steam Trap

For pressures
between 400 and
600 lbs. Body and
Cover of special steel

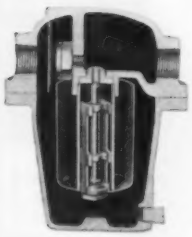
from 25″ vacuum to 600 lb. pressure

illinois STEAM TRAPS



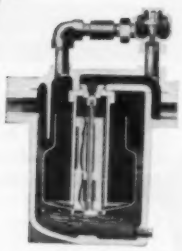
Series G Float
and Thermostatic
Trap

Standard Pressure
Range 15 pounds to
25 inches vacuum



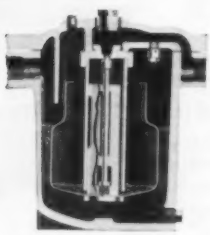
Number 30
Steam Trap

For Pressures up
to 150 pounds



Series 36
Steam Trap

For pressures
up to 30 pounds



Series 35
Steam Trap

For pressures
up to 250 pounds

Prevent Steam Waste—Save Fuel

No matter what your condensate drainage problem may be—for low, medium or high pressure steam or compressed air service—there is an Illinois Trap exactly suited to do the job efficiently, economically. You have a wide variety of types and sizes from which to choose. Before your next trap purchase investigate Illinois with its outstanding record for preventing steam waste and saving fuel. The Illinois representative nearest you will furnish facts and figures—or write for bulletins.

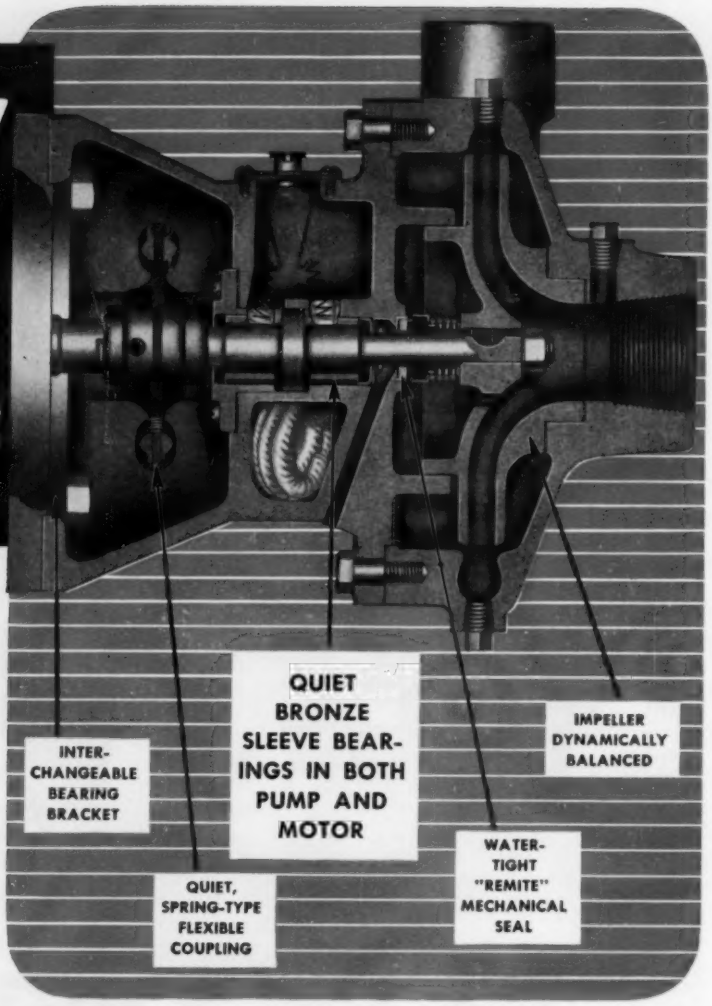
1900 55 1955 YEARS
illinois ENGINEERING
DIVISION OF AMERICAN AIR FILTER, INC.

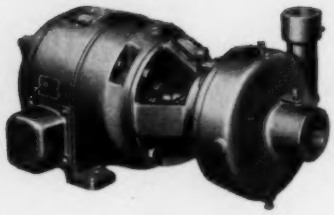
illinois ENGINEERING
ILLINOIS ENGINEERING COMPANY
DIVISION OF AMERICAN AIR FILTER COMPANY, INC.
2035 SOUTH RACINE AVENUE • CHICAGO 8, ILLINOIS

QUIETER!

GET RID OF NOISE TROUBLE IN YOUR COOLING INSTALLATIONS ...NEXT TIME BUY A

B&G SERIES 1522 CENTRIFUGAL PUMP


INTER-CHANGEABLE BEARING BRACKET
QUIET BRONZE SLEEVE BEAR-INGS IN BOTH PUMP AND MOTOR
IMPELLER DYNAMICALLY BALANCED
QUIET, SPRING-TYPE FLEXIBLE COUPLING
WATER-TIGHT "REMITE" MECHANICAL SEAL

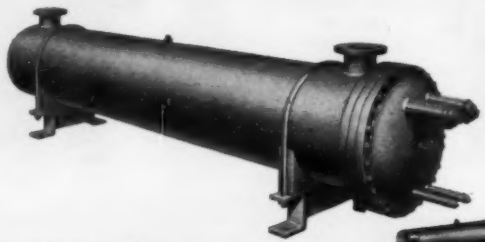


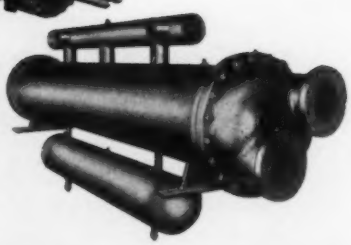
This pump is *really quiet*...because *both pump and motor* are equipped with long bronze sleeve bearings...and because of the noise-dampening flexible spring-type coupler.

The 1522 offers an outstanding array of other features for dependable, low-cost operation. The "Remite" Mechanical Seal, for example, ends leakage troubles. It's self-lubricating—*harder than glass*—wear-proof. The impeller is dynamically balanced for smooth, vibration-less operation...the entire bearing bracket assembly, including shaft and sleeve bearing, is interchangeable. Servicing is simple—the 1522 separates into three parts.

All these *plus* values cost no more—the B & G 1522 Pump is *competitively priced!* It is available as an all-iron, bronze-fitted, all-bronze or a stainless steel unit, with capacities to 150 GPM, heads to 115 ft. Send for Catalog.

Get the facts now on the latest in refrigeration and air conditioning equipment.





B & G precision-built Evaporators and Condensers offer time-tested design—rugged construction—scrupulous workmanship—all combined to provide top performance over a long service life. These units are built to ASME Code U-69 regulations and are certified by Hartford Steam Boiler and Inspection Service. Send for catalogs with new simplified engineering and selection data.

A complete line of refrigeration and air conditioning components . . . Centrifugal Pumps, Evaporators, Condensers, Liquid Receivers, and Heat Exchangers.

BELL & GOSSETT COMPANY

Dept. REB-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

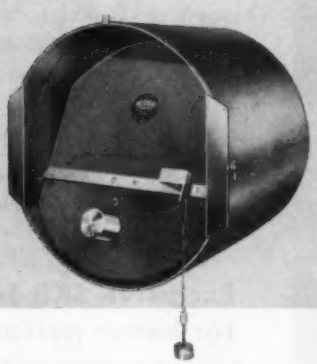
DEPENDABLE,

PRECISELY ACCURATE

Draft Control

for coal fired, oil fired, gas fired or gas-oil fired

HEATING PLANTS



FIELD TYPE "M" for coal and oil fired heating plants

Heavy duty commercial model in 28" and 32" sizes. Heavy, rigid construction assures long, trouble free service. Stainless steel knife edge bearing for permanent sensitivity. Also available in 6" through 24" sizes for domestic and commercial installations. First choice of heating men — the round control you can level on any flue.

FIELD TYPE "MG" for gas and gas-oil fired heating plants

A heavy duty, precision built control in sizes 8" through 32" for commercial and industrial installations. Stainless steel knife edge bearings for permanent sensitivity. Gate opens inward to regulate updrafts, and outward to relieve down-drafts. Optional safety switch available where codes require. Fully proven, accepted virtually everywhere.

They're real HEAVYWEIGHTS

Compare the weight of a Field Control to any other available. Here is proof of the massive, welded construction, long, vibration-free service, that permits Field's supreme accuracy.

Size Control	Gate	Thickness of Parts Side Plates	Ring	Collar	Wt. without Crtn. or Crate
14 M	16 Ga.	16 Ga.	⅜ x 2"	22 Ga. Galv.	19#
16 M&MG	16 Ga.	16 Ga.	⅜ x 2"	18 Ga. Galv.	28#
18 M	16 Ga.	16 Ga.	⅜ x 2"	18 Ga. Galv.	35#
20 M&MG	16 Ga.	16 Ga.	¼ x 2"	18 Ga. Galv.	41#
24 M&MG	14 Ga.	16 Ga.	¼ x 2"	18 Ga. Galv.	65#
28 M&MG	14 Ga.	14 Ga.	¼ x 4"	14 Ga. H.R.S.	110#
32 M&MG	14 Ga.	14 Ga.	¼ x 4"	14 Ga. H.R.S.	140#

field

FIELD CONTROL DIVISION

of H. D. CONKEY & COMPANY, Mendota, Ill.

Affiliates

Conco Building Products, Inc. • Brick, Tile, Stone
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at the lowest prices in history

NO SHOP CAN AFFORD TO BE WITHOUT ONE OF THESE 3 RUGGED NEW SKIL SAWS

New 6½" Model 864 only $64.50

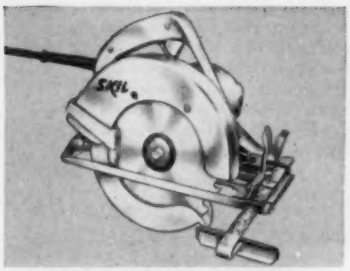
New heavy duty SKIL Saws offer a light weight compact answer to every cutting problem in the shop or on the job.

You'll find one of these SKIL Saws ideal to help you on every one of your heating, air conditioning or sheet metal jobs. This is a real heavy-duty construction tool, yet it's priced so low that it'll pay for itself in no time. Light weight, compact, powerful . . . use it to cut floor openings, duct entries, all materials including sheet metal, plaster, composition and even concrete.

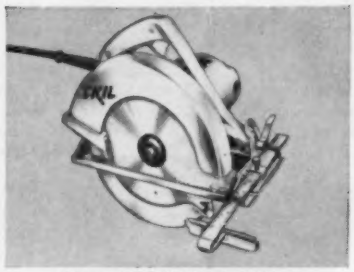
3 sizes—6½", 7¼", 8¼"—give you the right capacity for every job. New low prices give you big savings. And, all the famous SKIL features assure more profitable operation for you.

Exclusive SKIL features for better performance

- **Extreme light weight and the famous SKIL balanced design for easy handling.**
- **Easy, fast cutting in any position.**
- **High speed blade.**
- **Rugged, heavy-duty motor.**
- **Strong die-cast aluminum motor housing.**
- **Ball and needle roller bearings throughout.**
- **Quick-acting depth & bevel adjustment.**
- **Calibrated rip fence for both right and left hand cuts.**
- **Safety guard retracting handle for pocket cuts.**



New 7¼" Model 874 only $74.50



New 8¼" Model 884 only $84.50

BRIEF SPECIFICATIONS			
Model No.	864	874	884
Blade Diameter	6½"	7¼"	8¼"
Maximum Depth of Cut	2⅜"	2⅜"	2⅜"
Depth Cut at 45°	1¾"	1⅞"	2⅛"
No-Load Speed	6100 r.p.m.	6000 r.p.m.	5700 r.p.m.
Net Weight	11 lbs.	13½ lbs.	14¾ lbs.

SKIL PORTABLE TOOLS

Made only by SKIL Corporation
formerly SKILSAW Inc.
5033 Elston Avenue, Chicago 30, Illinois
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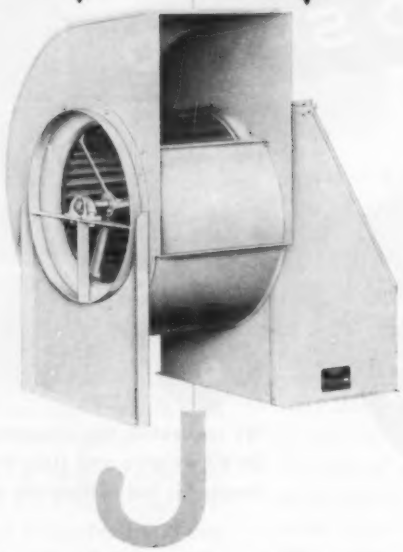
Factory Branches in All Leading Cities

Call your SKIL distributor for a Free on-the-job demonstration and a Free Trial

KEEP THE JOB OUT OF THE RED

(AND THE RAIN)



WITH UTILITY'S NEW ENCLOSED DRIVE BLOWERS 10″ TO 36″

Every roof installation can be right as rain no matter how much rain on the roof the years may bring. Utility has perfected a full series of high quality enclosed drive blowers, precision-engineered to withstand prolonged wind and weather abuse.

Their long life is further assured by permanently sealed, pre-greased ball bearings which require no further lubrication. They're forever impervious to dirt, dust, moisture and drastic temperature changes — and most important of all, to breakdown caused by lubrication neglect.

These new enclosed drive blowers follow the Utility quality pattern — a pattern that helps you sell the job in the first place, assures your profit in the second. Plan with Utility — and know you'll never see red on any job!

Write for full information on Utility blowers

UTILITY FAN CORPORATION

911 East 59th Street, Los Angeles 1, California

UTILITY

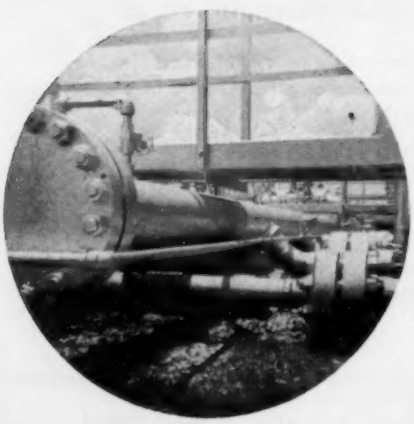
Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers.

A DIVISION OF UTILITY APPLIANCE CORP.

4500 psi Recycling Plant

$ 18,000 SAVED on branch connections alone!

By requesting the alternate use of Weldolet Welding Fittings in all weights and sizes the piping contractor was able to lower his bid sufficiently to be awarded the job!



This recently completed recycling plant in Louisiana was designed and engineered in full accordance with the ASA and ASME Codes and operates at a maximum pressure of 4500 psi and 225°.

The piping engineers on this job were confronted with a number of tough problems. The plant was to be operated at extremely high pressures. The terrain was swampy which meant the fittings had to withstand the additional stresses exerted by a settling foundation. The piping also had to stand up under rugged vibration conditions. The many design features of Weldolet Welding Fittings in both full size and reducing size outlets provided the safe, practical and most economical answer to these knotty service problems.

WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

715 MEADOW STREET, ALLENTOWN, PENNA.

Now

"Budget-Priced" CORROSION PROTECTION

for the Small to Medium Steam Plant

The New SCHAUB "03" *Deaerator*

- ***Combats "Return Line" Corrosion***
- ***Simpler in Principle***
- ***Gives Positive Oxygen Removal to .03 CC/Liter***

It is in plants of 3,000 to 30,000 lbs/hr boiler capacity — often operating at low pressure — that "return line" corrosion is most apt to rear its ugly head. This happens even when raw water make-up is negligible.

The Schaub .03 Deaerator was designed especially for these plants. It offers an effective and economical way to "clean up" boiler feedwater that will pay for itself many times over. It is equally applicable to high pressure installations.

The *big* difference in the Schaub .03 Deaerator is that it operates fully vented at *atmospheric* pressure. Noncondensible gases escape *immediately* and *completely*. Premium cost construction is eliminated, maintenance and operating costs are reduced to a minimum. Simple but effective spray-contact vent condensing prevents wasteful steam vapor loss. Pin-point temperature control, "live action" heating, and rust proof Chromasoid lining are exclusive features.

FRED H. SCHAUB ENGINEERING COMPANY

2116 South Marshall Boulevard • Chicago 23, Illinois

Write for Bulletin 1300 — and the full story on this low-cost, more efficient Deaerator.

Simple as it is, there's a lot more to the Schaub .03 Deaerator than can be told on this page. Bulletin 1300 is filled with facts for the operating or consulting engineer responsible for boiler feedwater deaeration. It tells the "hows" and "whys", and the basic differences in the Schaub .03 method. Mail the coupon now. No obligation, of course.

NOTE: The Schaub .03 Deaerator is designed for boilers up to 1,000 HP. or 30,000 lbs. per hour. For capacities up to 100,000 lbs. per hour at .005 cc/liter "zero-oxygen" removal, write for Bulletin 575, describing the Schaub Zero-Oxygen Deaerator.

FRED H. SCHAUB ENGINEERING COMPANY
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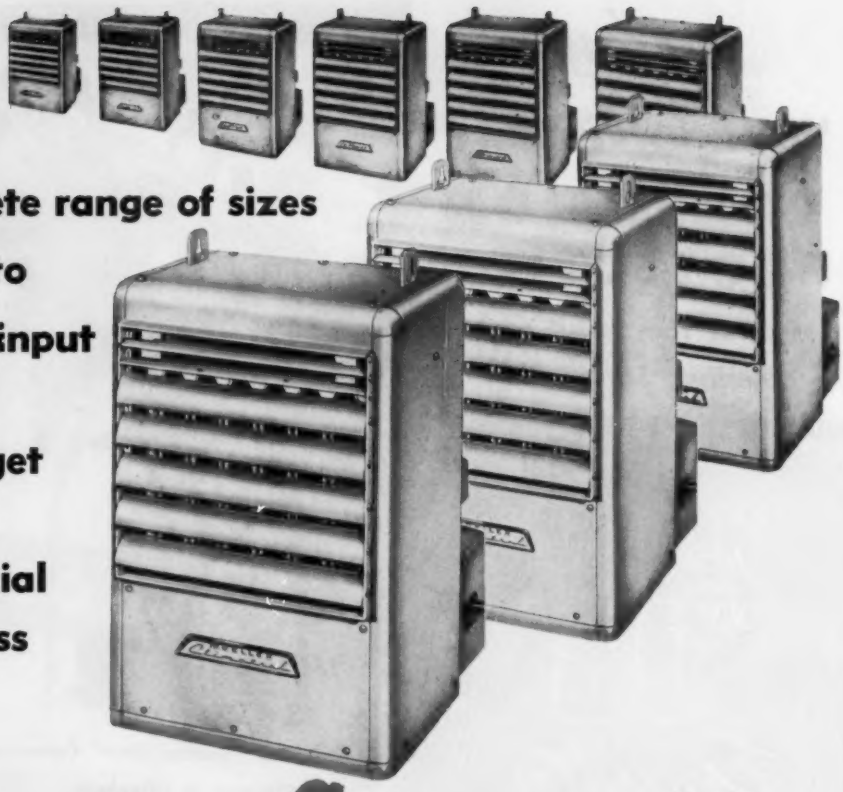
Please send me, without cost or obligation, my personal copy of your new Bulletin 1300 on Boiler Feedwater Deaeration.

Name.....

Company.....

Address.....

City.....Zone....State.....



Now—a complete range of sizes from 25,000 to 225,000 BTU input

...to help you get a bigger share of the commercial heating business

Mueller Climatrol

Type 160 Gas, Direct-fired Unit Heaters

Here's the perfect answer to your space heating problems — Mueller Climatrol Type 160 gas, *direct-fired*, suspended unit heaters. They're compact, attractive, efficient — easy to install and service.

The Type 160 is A.G.A. approved for use with natural, mixed, manufactured, and propane gas. Check these "advance design" features built in this unit.

Compact — only 29½" x 19½" x 12" (for the 50,000 Btu size.)

Easy to Install — shipped pre-wired and pre-assembled. Easy to hang.

High Crown Sheet — no "hot spots," no joints or welds exposed to flame.

Welded-Steel, Air-Tube-Type Heat Exchanger — for maximum heat extraction, efficiency, *longer life.*

Quiet Fan — propeller type, properly pitched for even air distribution.

Cast-Iron, Drilled-Port Burner provides even heat distribution over entire hearth area.

Built-In Diverter with rear flue outlet.

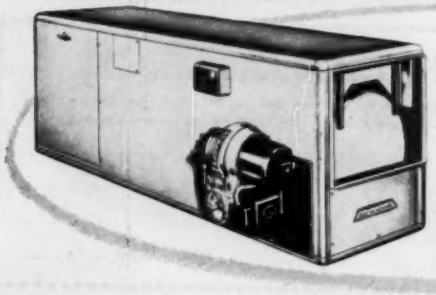
Adjustable louvers let you direct the air where you want it.

Smooth Finish in Mountain Spring Green color, easy to repaint to match room decor.

Write for facts and figures that tell you more about this Mueller Climatrol unit heater line.

Mueller Climatrol

DEPT. 2105, 2023 W. OKLAHOMA AVE. • MILWAUKEE 15, WIS.



Also the Type 253 Oil-fired Unit Heater

This modern oil-fired unit is available in four sizes — 110,000, 150,000, 200,000 and 250,000 Btu input. It can be suspended as a unit heater or it can be used as a horizontal furnace in homes for perimeter, radiant warm-air and conventional, forced, warm-air heating. Equipped with a large, quiet blower, the Type 253 is shipped assembled and pre-wired.

98th Anniversary

D-179

BALTRIC

THE BANTAM THAT PACKS A HEAVYWEIGHT PUNCH

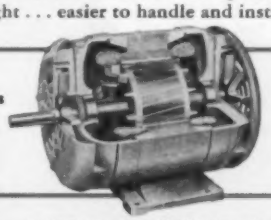
The new *Streamcooled Baltric* line of completely enclosed motors are champions, every one, all sinew and muscle . . . compact, powerful, efficient. Advanced engineering using the newest materials, enables Baltric to offer you hard-working power packages.

These are tomorrow's motors today! Greater efficiency with less weight and bulk . . . insulation is lighter and better.

Built to NEMA standards, Baltric's your best bet . . . doesn't waste space . . . doesn't waste weight . . . easier to handle and install.

BE59-5

- Exclusive One-piece Stator Frame
- Rotor Provides Improved Torque Characteristics
- Solid End Plates Completely Enclose Motor
- Base Design Permits Flexibility In Installing Or Replacing



Original *Streamcooled* Motors Also Available — Built to Former NEMA Standards

ALL *BALTRIC* MOTORS TOTALLY ENCLOSED AND *STREAMCOOLED*

BALDOR ELECTRIC COMPANY

Baltric Motors Are Available In Polyphase • Squirrel Cage • Induction and Single Phase • Capacitor Start • Induction Run Types

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BRUNER
WATER SOFTENERS & FILTERS

for Industrial Installations

Hundreds of Bruner Industrial Water Softener installations are proving their superiority in military bases, industrial plants, hotels, hospitals, schools and colleges in all parts of the United States, Canada, Alaska and South America.

Examples of Bruner industrial installations:

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University of Wisconsin — Madison, Wis.
University of Missouri — Columbia, Mo.
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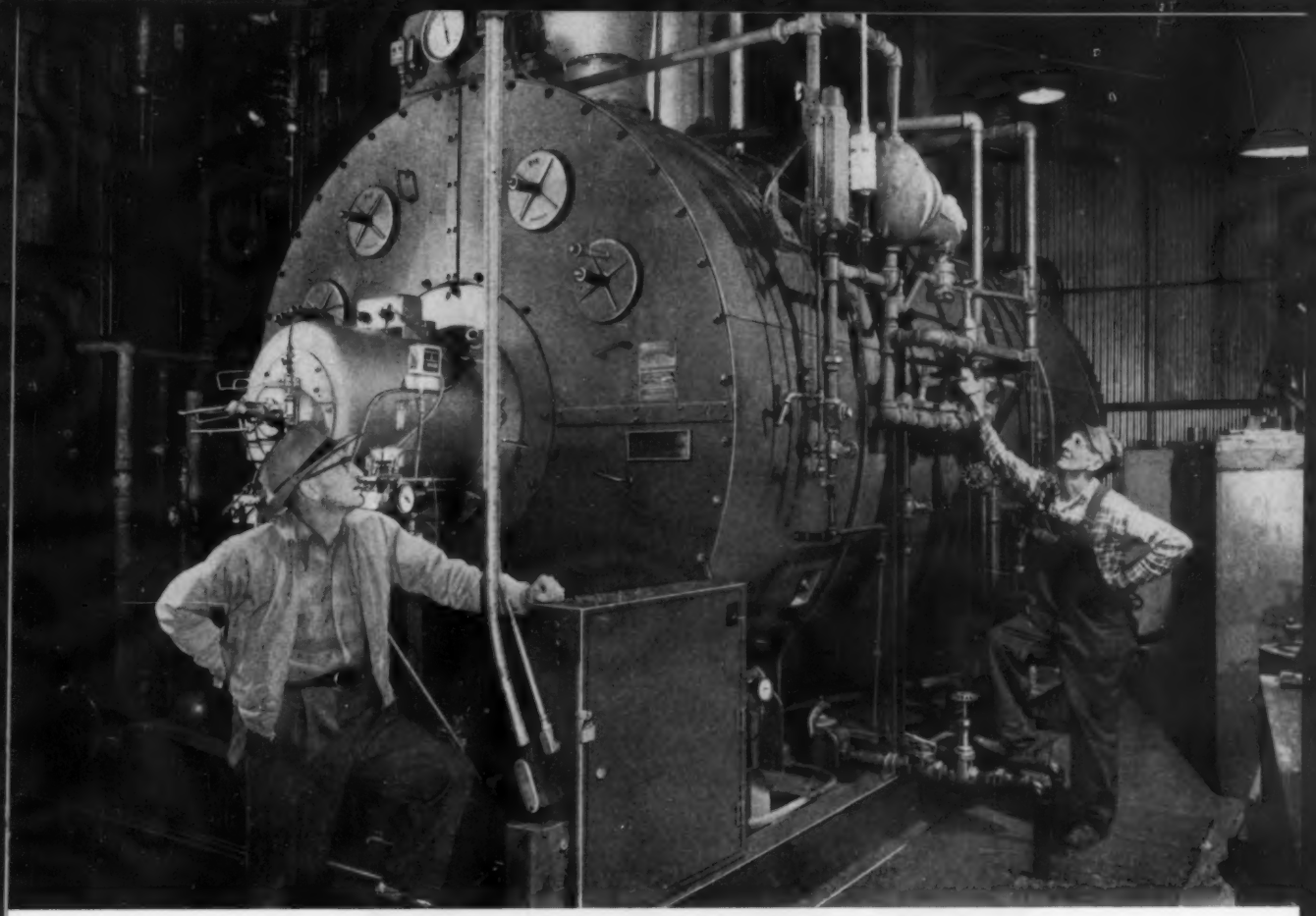
There are Bruner Sales and Engineering offices in principal cities. Your inquiry will receive immediate attention.

Manual and Fully Automatic softeners in capacities up to 1,500,000 grains are carried in stock. Larger capacities and special equipment to treat unusual water conditions engineered to meet your requirements.

BRUNER Corporation

4763 N. 32nd Street • Milwaukee 16, Wisconsin

Sales Offices in Principal Cities • Plants in Milwaukee and Santa Barbara



Why does ONE *Powermaster*® sell OTHERS in nearby plants?

You get MORE than Operating Efficiency with Powermaster

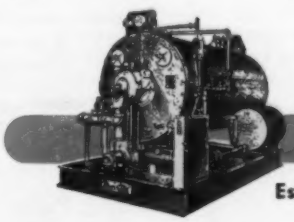
- ★ Low-cost, space-saving installation
- ★ Fast steaming
- ★ Instant response to load changes
- ★ Quick fuel change-overs
- ★ Clean, dry steam
- ★ Automatic operating and safety controls
- ★ High fuel economy at all loads
- ★ Clean, quiet operation
- ★ Smokeless combustion
- ★ One-source responsibility for complete unit
- ★ Nation-wide factory-trained service organization
- ★ Pay-As-You-SAVE Purchase Plan

This 500 HP *Powermaster* Packaged Automatic Boiler installed in a West Coast food processing plant has led to the purchase of four *Powermaster* units by other companies in the same area.

The reason for these extra sales is because *Powermaster* is solving two steam problems—more steam for processing, and more efficient off-season heating by means of modulating control of firing rate.

You can now purchase a completely factory-assembled and fire-tested *Powermaster* on the new Pay-As-You-SAVE Purchase Plan that helps you pay for your new boiler out of the savings it brings you.

Write for Bulletin 1220 or ask our representative to tell you how *Powermaster* can meet your requirements.



Powermaster®

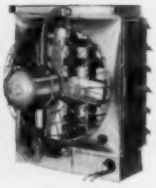
PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.

ORR & SEMBOWER, INC.

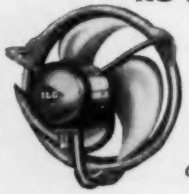
Established 1885 • Morgantown Road, Reading, Pa.

ILG Unit Heaters
The complete line—steam, hot water, gas or electric—with capacities ranging from 18,600 to 286,000 BTU.



ILG Centrifugal Fans
Designed for a wide variety of pressure and volume requirements—certified capacities ranging from 374 CFM to 116,400 CFM.

ILG Propeller Fans
Feature ILG's self-cooled motor, direct-connected to fan wheel—assures extra quiet, low-cost operation. Sizes from 6" to 72".



FOR POSITIVE, CONTROLLED ROOF EXHAUST...

Year in, year out, rain or shine, Ilg Power Roof Ventilators are always on the job. They provide powerful, positive maintenance-free discharge of stale air or fumes. Designed to meet rigid requirements, they are ideal for the tough ventilating problems encountered in hotels, apartment buildings, office buildings and factories, large or small. The "PRV" unit shown above features a direct-connected centrifugal fan . . . ideal for remote roof operation with double-sealed permanently lubricated ball bearings for exhaust from vertical flues or from duct systems . . . no belts to use up power, wear or break. Available in 40 different capacities. Other types available meet every roof ventilator need . . . all are "capacity certified" in accordance with A.S.H.V.E. and PFMA test codes.

Ilg Power Roof Ventilators Require No DRIVE or BEARING Maintenance

Complete Details . . . FREE

Write today for your free copy of this illustrated Catalog. Ask for Bulletin No. 1903.

ILG ELECTRIC VENTILATING COMPANY
2826 N. Pulaski Road, Chicago 47, Illinois
Offices in 57 principal U. S. cities—all principal foreign cities

How to Select an Economical Temperature Regulator

First of all, what does *economy* mean where temperature regulators are concerned? In some industries it means improvement of product or reduction of spoilage through closer control of process temperatures. In others, it means the paring down of operating expense. The price of the regulator itself is a relatively small factor.

Today's buyers are shopping for:

1. Accuracy of control — not only when the regulator is new, but throughout its service life
2. Dependability — to prevent loss of production time
3. Minimum installation and maintenance cost

Here are a few tips on what to look for when you're installing a new or replacing an old temperature regulator —

Packless construction . . . and for this reason: A diaphragm operated, packless regulator minimizes friction. There are no closely fitted parts to stick or bind because of uneven expansion or collection of foreign matter. Also, there's less maintenance, since no repacking is ever required.

A guarantee against wire drawing of the seats and discs. Insist on it. This guarantee in combination with single seat design assures you of tight shutoff; you avoid expensive steam losses as well as loss of product in a process application.

Broad control range. In a standard regulator you should expect a control range of 100 F. And make sure the unit you select has a vapor tension thermostat that can take over-temperatures of at least 100 F.

Easy maintenance. Why ask for grief? Your temperature regulator should be basically simple in design so that it can be serviced by average plant personnel. All parts should be readily accessible for testing and cleaning.

Double duty. There's no point in buying a separate pressure regulator when you can select a temperature regulator that combines both temperature and pressure control within the same unit.

Self-operating. Make sure you get a regulator that operates on its own initial pressure. By doing so, you avoid the purchasing and maintenance of an air compressor plus air piping, and you're sure of uninterrupted operation during electric power failures.

• • • •

All of these points are important to you when it comes to selecting an economical temperature regulator. Perhaps you didn't realize you *could* expect so much. And perhaps you didn't realize that Spence Temperature Regulators offer all these features and more. May we send you our Bulletin T 500 containing further details? SE 128

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

Jenkins designed for trouble-free performance... a

STAINLESS STEEL "Y"

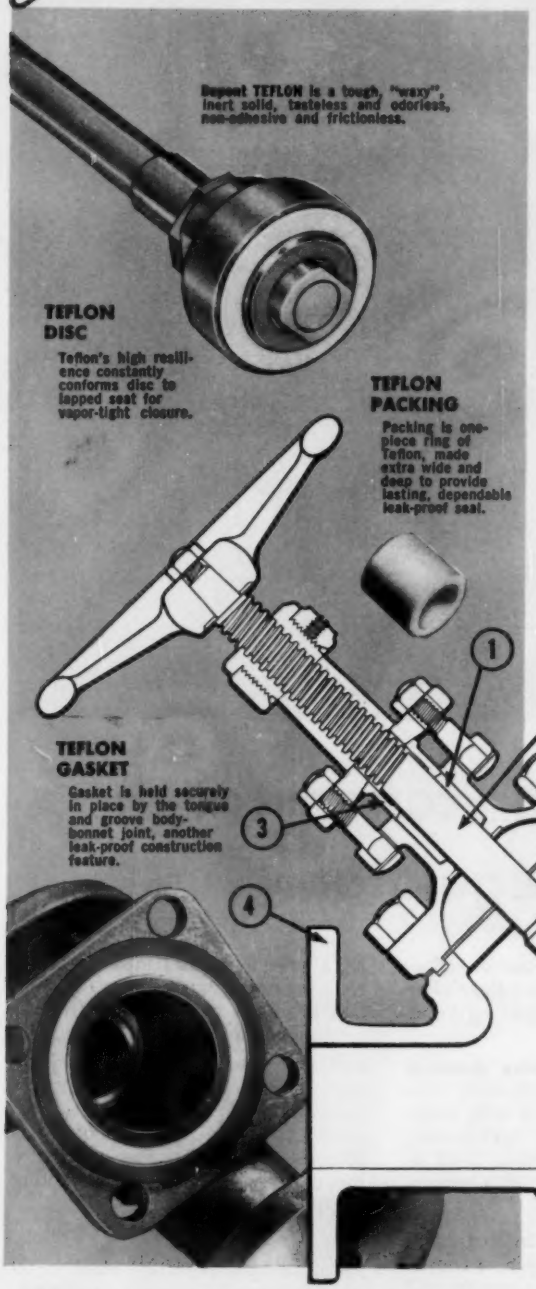
to lower costs in a wider range of

CORROSIVE SERVICES

For food and chemcial plants, and similar services, Jenkins Fig. 1335 "Y" Globe offers many advanced features that will lower operating costs and keep your processing lines trouble-free. The disc, packing, and gasket are tough, resilient Teflon. Tasteless and odorless, it eliminates problems of contamination.

The "Y" pattern permits full flow, nearly equal to that of a gate valve, and also provides the vapor-tight closure and the ease of disc renewal of a globe valve.

Fig. 1335 offers extra value by any test . . . *initial cost, operating efficiency, low maintenance.* You can convert this extra value into *extra savings* on your toughest corrosive services. Call your Jenkins Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17.


Dupont TEFLON is a tough, "waxy", inert solid, tasteless and odorless, non-adhesive and frictionless.
TEFLON DISC
Teflon's high resilience constantly conforms disc to lapped seat for vapor-tight closure.
TEFLON PACKING
Packing is one-piece ring of Teflon, made extra wide and deep to provide lasting, dependable leak-proof seal.
TEFLON GASKET
Gasket is held securely in place by the tongue and groove body-bonnet joint, another leak-proof construction feature.
1
2
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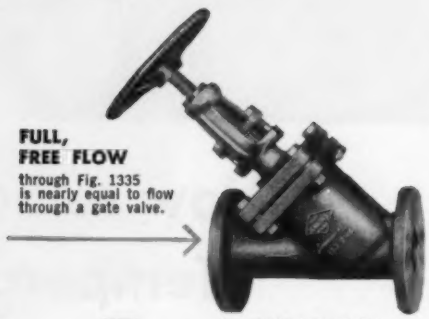


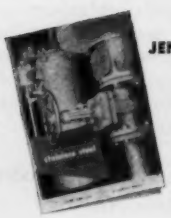
Fig. 1335 "Y" GLOBE
150 lbs. O.W.G. at 500°F
230 lbs. O.W.G. at 100°F
Sizes 1" to 4"

(1) **Packing Box**—Exceptionally deep and wide to hold optimum size packing.

(2) **Spindle**—Polished shank, long-operating threads, bevel shoulder for backseating.

(3) **Gland**—Two-piece for equalized pressure, tight seal.

(4) **Flanges**—Conform to M.S.S. Standard Practice S.P.42 Specifications.



JENKINS STAINLESS STEEL VALVE BOOKLET illustrates and describes wide range of Jenkins Globe, Gate, Check, and Y Valves, includes selection data, survey forms. Ask for Form 200-A.

JENKINS VALVES

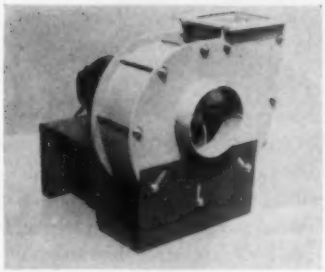
LOOK FOR THE JENKINS DIAMOND

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros.

EQUIPMENT DEVELOPMENTS...

For reviews of Recent Trade Literature see Page 242

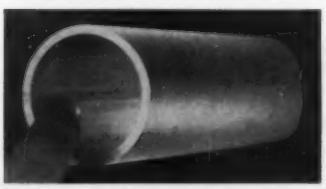


Solid Plastic Fans . . .

. . .for corrosive fume removal—Heil Process Equipment Corp., 12901 Elmwood Ave., Cleveland 11. "Rigivin" (rigid vinyl, high impact type), "Rigidon" (glass fiber reinforced plastic) fans designed for fume removal under severe corrosion conditions at temperatures to 200 F. Cited features: high efficiency, quiet operation, nonoverloading characteristics. With variable discharge positions for plain or flanged inlet, outlet connections.

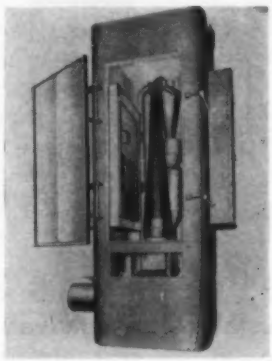
Radiant Wall Panel . . .

. . .designed for mounting ease, with sturdy, all metal construction—Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8. Design of heating element is said to protect against electrical shocks, is guarded against moisture, rough usage. Factory assembled, unit may be surface mounted or recessed against wall studs.



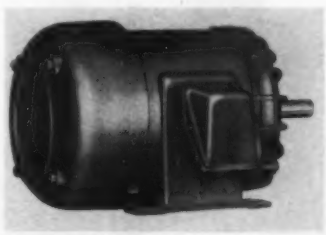
Welding Process . . .

. . .for manufacturing welded stainless steel, high alloy tubing and pipe —Trent Tube Co., East Troy, Wis. "Trentweld" method formulated to reduce or eliminate weld bead on inside diameter of tubing after welding. Rolls inverted and formed tubing welded from underside to permit gravity to eliminate bead. Cited improvements over old process: better physical properties and appearance, corrosion resistance.



Dust Collector . . .

. . .for industrial plants—Green Fuel Economizer Co., Beacon, N. Y. "Aerodyne's" packaged design consists of louvered cone for coarser particles, fiber filter packs for submicron particles and condensable elements. In capacities 1000 to 10,000 cfm free air. Power requirements range 1½ to 15 hp with motor assembled with unit.



Fan Cooled Motors . . .

. . .in 1 to 5 hp series—Century Electric Co., 1806 Pine St., St. Louis. Recommended by company for use in dirty, dusty, fume and mist laden atmospheres. Cited features: sturdy aluminum rotor; intake, exhaust ventilating fan without changing; plastic coated stator windings; availability of brackets for bolting motor to machine, machine to motor.

Pipe Fittings . . .

. . .injection molded on commercial scale—Tube Turns Plastics, Inc., 224 E. Broadway, Louisville 1. Are said to be first in 3, 4 in. sizes of unplasticized polyvinyl chloride to be made this way. Line includes 90 and 45 deg elbows, tees, couplings, flanges. Makes possible economical erection of larger size PVC piping systems planned in chemical, petroleum, other fields, says company. In normal, high impact PVC, threaded and socket types. Cited features: resistant to corrosion attack, easy to erect and disassemble.

Lightweight Hose . . .

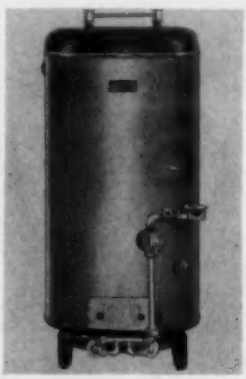
. . .designed to protect against exterior wear from contact with rough, abrasive surfaces—Flexaust Co., 100 Park Ave., New York 17. "Flexaust" hoses, "Portovent" retractable ducts have vinyl wearstrip bonded over spiral wire reinforcement. For air conditioning, ventilating, dust collection, fume control, materials handling uses. Also opens possibilities for applications up to now too severe for lightweight hoses, says company.

EQUIPMENT DEVELOPMENTS

Continued

Air Compressor . . .

. . . with small, compact design—Bell & Gossett Co., Morton Grove, Ill. Designed to produce oil free air from twin piston design. Uses new concept in cylinder wall lubrication. Has specially constructed graphite or carbon piston rings. Carbon serves as dry lubricant. Recommended by company for paint spraying completed piping jobs, pressure testing new piping for leaks, conversion to operate as vacuum pump. Rated for continuous operation at 35, 75, 175 lb, 1/4 to 3/4 hp.

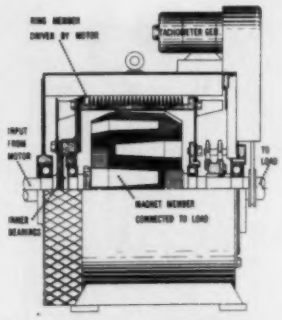


Water Heaters . . .

. . . for restaurants, motels, schools, churches, etc.—Ruud Mfg. Co., Kalamazoo 1, Mich. "Sanimaster" automatic storage gas unit in two models have solid aluminum alloy tanks of multi-tube design. Model "AST72-126" uses natural, mixed, manufactured gas. Has 72 gal storage rating, 60 gal nominal tank size, 126 gal per hr recovery at 100 deg rise. "AST72-105" uses LP gases, has same storage rating and nominal tank size, 105 gal per hr recovery at 100 deg rise.

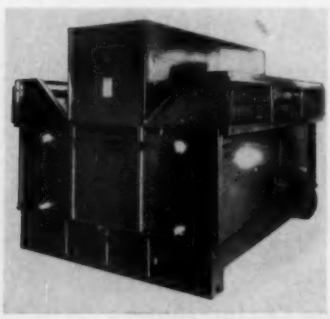
Outer Jacketing . . .

. . . for insulated pipes designed with new feature—Aljon Mfg. Co., 54-18 43rd St., Maspeth, N. Y. Of corrugated aluminum, has inner lamination of kraft paper and polyethylene to provide moisture barrier. Protects against electrolytic corrosion of aluminum. For temperatures to 350 F. In 4 ft widths, lengths of 100 ft.



Adjustable Speed Drive . . .

. . . designed for wide application range—Electric Machinery Mfg. Co., Minneapolis 13. "Ampli-Speed" can be coupled or belted to existing motors for speed control of ± 2 percent for fans, centrifugal pumps, compressors. For use with motor speeds 870, 1150, 1750 rpm. Rated to 95 hp for fan type loads, to 75 hp for constant torque.

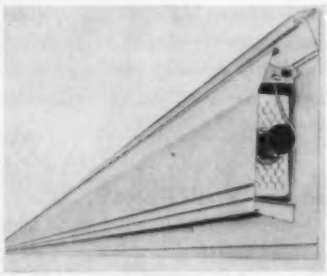


Heat Exchanger . . .

. . . designed for water saving in industrial cooling, control of temperatures within 2 F deg—Niagara Blower Co., 405 Lexington Ave., New York 17. Panel casing aero unit cools by evaporation, controls temperature by modulating use of outdoor air. In four sizes with capacities 7 to 18 million Btu per hr.

Vibration Mountings . . .

. . . for heavy duty, general purpose applications—T. R. Finn & Co., Inc., Industrial Div., Hawthorne, N.J. Consist of semi-steel housing containing helical steel springs, rubber thrust bumpers, nylon dampers, steel base plate with sway control assemblies. Bolt secures mounting to machine, provides means for leveling. In 41 standard sizes with rated load capacities 100 to 6500 lb and over.



Baseboard Radiation . . .

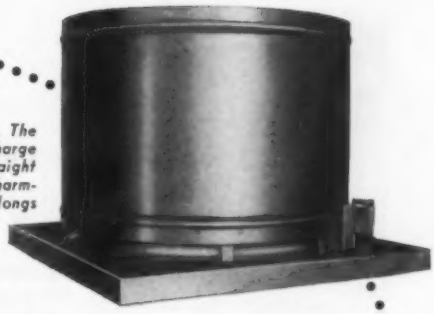
. . . featuring 1 in. copper tube element in restyled enclosure—Brown Products Co., 97-12 Metropolitan Ave., Forest Hills, N. Y. Has 2 1/4 in. maximum depth, can be recessed to greater shallowness. Integral dampers built into each 8 ft section. Hanger bracket design speeds installation.

Belt Drive . . .

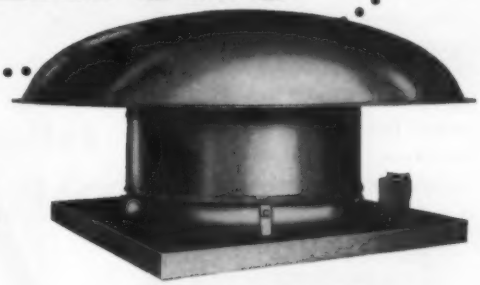
. . . designed as timing part or power transmission belt—New York Belting & Packing Co., "Timing" Belt Div., Tacony, Philadelphia 35. Has tooth-grip feature said to make positive engagement with grooved pulleys. Helically wound steel cable pulling element gives increased tensile strength, says company. Element embedded in neoprene. Cited features: positive drive, precision timing, operates at low or high speeds,

***For whisper-quiet operation** on schools, hospitals. The all-new Centrifugal Roof Ventilator runs at low speeds, moves large volumes of air efficiently against static pressures.*

***For oil or grease laden air.** The newly redesigned Vertical Discharge Roof Ventilator exhausts air straight up at high velocity. It keeps harmful residue off the roof . . . prolongs roof life.*



3 new LOW-SILHOUETTE ROOF VENTILATORS



The Power-Flow Roof Ventilator is a ruggedly built unit in an aerodynamically correct, weatherproof housing. Most popular of all for general useage.

Low in silhouette . . . distinctively profiled . . . these units blend well with modern architecture. What's more, they deliver all the air you pay for. All performance ratings are the output of the *completely assembled* unit . . . obtained from wind tunnel tests as per Standard Test Code for Power Roof Ventilators . . . conform to U. S. Department of Commerce Standard 178-51. Capacities up to 40,900 CFM. Send for catalogs today.

3 New catalogs

MAIL COUPON TODAY

De Bothezat FANS
A DIVISION OF
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

DeBOTHEZAT FANS, Dept. HP-1055
Division of American Machine and Metals, Inc.
East Moline, Illinois

Please send catalogs on your following roof ventilators . . .

- ☐ *Centrifugal,* for quiet operation
- ☐ *Vertical Discharge,* for oil or grease laden air
- ☐ *Power-Flow,* for normal industrial air
- ☐ All three ventilators

FIRM _____

ADDRESS _____

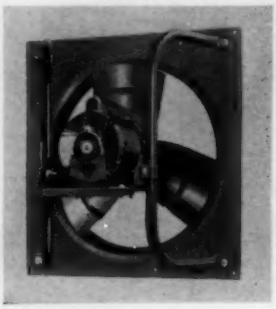
CITY _____ ZONE _____ STATE _____

ATTENTION MR. _____

EQUIPMENT DEVELOPMENTS

Continued

no initial tension, low noise level, no lubrication required, ease of installation, versatility.

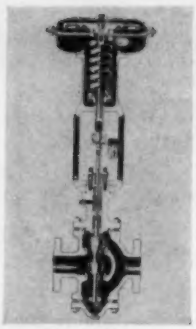


Exhaust Fan . . .

. . . for industrial installations—American Blower Corp., Detroit 32. Ruggedly constructed, heavy duty type. With two-speed or constant-speed direct drive totally enclosed motors. In capacity range 587 to 12,800 cfm. Operates against static pressures to ⅝ in. Streamlined inlet designed to permit free air flow with minimum resistance in exhausting smoke, fumes, other contaminants.

High Sensitive Relay . . .

. . . for control of high power, high current loads to 60 amps or 3 hp at 115 volts, a-c from devices or circuits in impedance values ranging 10 megohms to 100,000 ohms—Ebert Electronics Corp., 212-26 Jamaica Ave., Queens Village 28, N. Y. Low current, low power will activate, also, says company. Available for control of loads to 35 amps or 2 hp at 115 volts a-c—for either normally open or normally closed operation. Cited features: complete a-c operation, no rectifiers or sensitive armature type relays employed, only one moving part in unit, built-in power line isolation.

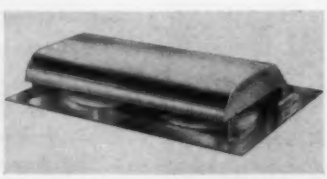


Diaphragm Valves . . .

. . . with direct acting, reverse acting construction—Fisher Governor Co., Marshalltown, Ia. Have bolted clamp type stem connection designed to allow stem adjustment of 50 percent total travel in either direction. Will not shake loose from vibration or rotational inner valve forces, can be disconnected in field without damage to stem, says company.

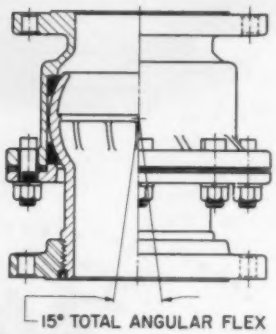
Velocity Meter . . .

. . . for measuring throat velocities on ceiling air diffusers—Bacharach Industrial Instrument Co., 7301 Penn Ave., Pittsburgh 8. Instrument's "Air Scoop" inlet fits both circular, square diffusers. Readings obtained by holding open end of inlet against diffuser outlet. Has 0 to 2500 fpm range.



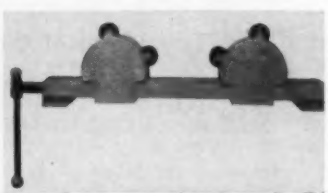
Double Roof Ventilator . . .

. . . for jobs requiring extra large ventilating areas—Leigh Building Products Div., Air Control Products, Inc., Coopersville, Mich. Has 75 sq in. free area. Features two venturi openings, side by side in base of unit. All aluminum construction. Has one piece base, special weather baffle to prevent leakage from rain, snow. Easy, quick installation, says company.



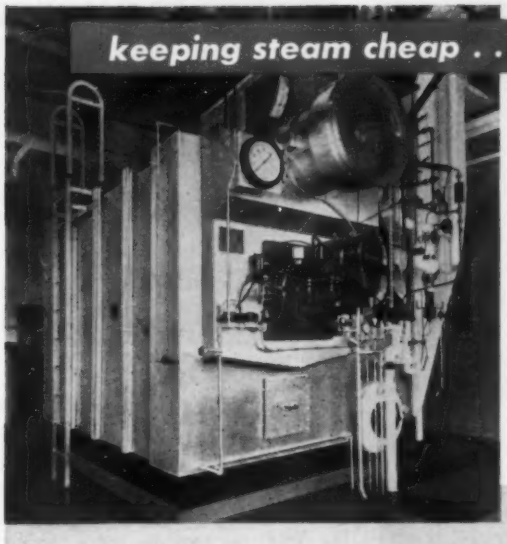
Ball Joints . . .

. . . with new design in 8, 10, 12 in. sizes for piping—Barco Mfg. Co., 500 Hough St., Barrington, Ill. In flanged end, welding end patterns in steel or bar-ductile metal. Flanged end joints have 150 or 300 lb flanges. Welding end joints suitable for 600 psi steam, operating temperatures to 1000 F. All are lighter, stronger than previous design, says company. Both patterns may be equipped with gasket for gasoline, oil, water, noncorrosive chemicals, steam to 300 psi.



Combination Pipe Dolly . . .

. . . designed to reduce pipe handling time up to 85 percent—H & M Pipe Beveling Machine Co., Tulsa, Okla. Provides for adjusting pipe over variation of several inches. To use, set travelling heads in partially closed position, load pipe in dolly, check level, rotate adjustment handle to lower or raise pipe until leveled. Rollers permit rotating for manual or automatic welding. Dolly handles pipe sizes to 36 in. Has 2500 lb load capacity.



B&W Integral-Furnace, Type FM Unit which supplies steam for all plant purposes.

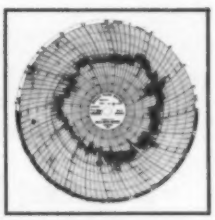
Main plant building of Shulton, Inc.

Engineers: Emil Gruenberg & Associates, N. Y. C.
Architects: Drake, Tuthill, Convery & Cueman Associates Summit, N. J.

B&W FM Boiler Supplies NEW STEAM FOR *Old Spice*

Production lines are humming at the beautiful Shulton, Inc., plant in Clifton, New Jersey, as this leading toiletries manufacturer hustles to keep pace with the huge and growing demand for its *Old Spice* and other lines of popular products. Started from scratch less than 20 years ago, Shulton, Inc., now makes its own dies, boxes, packages, and plastic closures for the toiletries which today sell in 28 countries and the United States.

Production on this scale requires a reliable source of economical steam for heating, hot water, and processing operations in the plant's chemical and packaging divisions. When maintenance costs on the two original boilers at the plant began to rise, a B&W FM Unit to provide 15,000 lb of steam per hr at a pressure of 150 psi was installed and went into service last February. The unit burns up to 1600 gallons of #5 oil in 24 hrs., depending upon load. With a return as high as 75%, makeup water required runs between 25 and 50%. Mr. N. J. Fowler, Plant Engineer in charge of Shulton's Clifton operation, declared that "the FM handles wide load swings extremely well and everyone concerned is very happy with the new boiler."



Like *Old Spice*, B&W FM Boilers are quality products. They have earned a reputation for efficient, economical steam generation for power, processing, and heating in a broad range of industrial, commercial, and institutional applications. Available in standard sizes with individual capacities to 40,000 lb of steam per hr and pressures to 235 psi, many FMs are in service at higher pressures and with moderate superheat. Note the list of cost-saving features typical of this versatile unit.

Write for the detailed description of the FM in Bulletin G-76. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

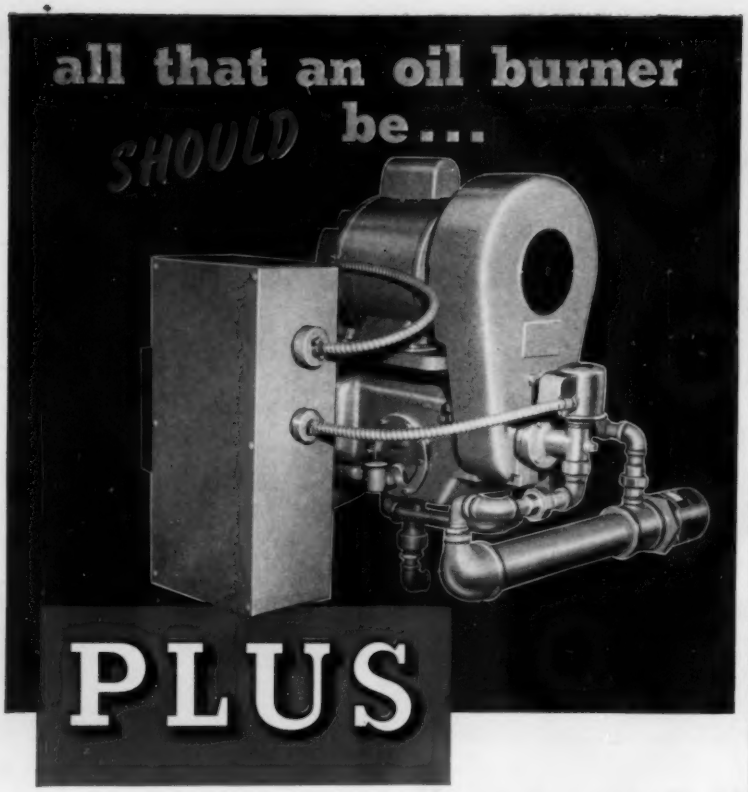
G-729

COST-SAVING FEATURES

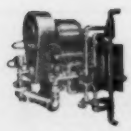
- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Suitable for Outdoor Service
- Safe, Automatic Operation
- Saves Space
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel

BABCOCK & WILCOX

BOILER DIVISION



Designed and built to provide the most complete combustion with an absolute minimum of supervision and maintenance, Superior Rotary Burners combine the best time-tested features of horizontal rotary atomization with dependable automatic firing, plus . . .



THE 4-HOLE HINGE

This hinge has the effect of placing the primary pump between the fuel oil tank and the oil heater, permitting higher oil temperatures as required by modern catalytic oils, and eliminating the pump strain in pulling cold oil through the heater.

MORE POSITIVE VISCOSITY CONTROL

Superior's Constant Oil Rate Control provides uniform firing *throughout the entire firing range of the burner* regardless of viscosity variations in the fuel.

CONSTANT GAS PILOT

On Superior Combination Gas/Oil Burners, a continuous gas pilot remains lighted throughout all stages of the gas-firing cycle. Insurance records show that constant gas pilots provide the maximum operating safety. Superior's constant-burning gas pilot provides the greatest protection and the most positive ignition known to modern gas combustion . . . write for Catalog 2604.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 18, N.Y.

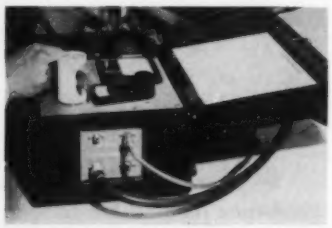
SUPERIOR ROTARY BURNERS

EQUIPMENT DEVELOPMENTS

Continued

Aluminum Jacketing . . .

. . . for weatherproofing of outdoor insulation—Childers Mfg. Co., 3620 W. 11th St., Houston 8. "Lap-Seal" is series of eight ribs rolled into underlapping edge of jacketing. Seal is said to provide more positive weather seal. Eliminates measuring for circumferential lap. Cited features: ease of handling, installation, attaching; freedom from maintenance.

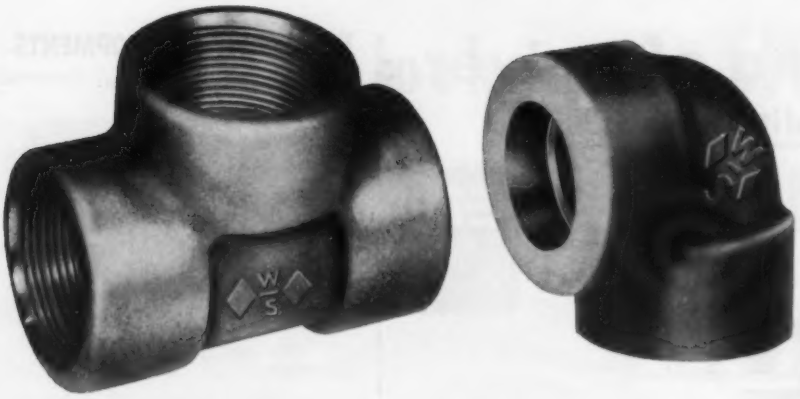


Dewpoint Indicator . . .

. . . with portable, manually operated design for measuring moisture in gases—General Electric Co., Instrument Dept., Lynn, Mass. For applications where only periodic checks desired. Determines moisture content by measuring temperature at which moisture condenses. Gives readings from ambient to −100 F (0.0003 percent moisture by volume in air). Operates on self contained battery.

Stud Driver . . .

. . . designed for versatility in fastening structural material to steel, concrete—Remington Arms Co., Inc., Bridgeport, Conn. Has interchangeable barrels for specific jobs. Hammers nail-like studs through structural materials with controlled blast of 32 caliber blank cartridge.

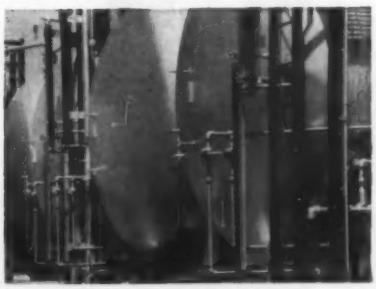


WATSON-STILLMAN FORGED STEEL FITTINGS FOR: *Safe, Tight Connections* in pressure piping

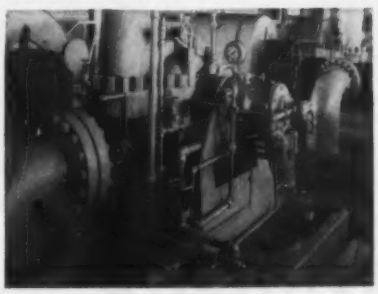
■ In high pressure steam lines... process liquid and gas piping... hydraulic fluid lines... wherever strong, tough pipe joints are needed, Watson Stillman Forged Steel Fittings provide a safety factor against costly piping failures. They resist pressure, heat, corrosion, shock and vibration because they're drop-forged of high quality steel to produce a dense, tough, forged-fiber structure that can really take it.

Extra strength is built into W-S fittings in other ways too... such as the heavy reinforcing bands extending well beyond the threads or sockets.

Protect your high pressure piping system with Watson-Stillman Forged Steel Fittings. Available in carbon, stainless and alloy steels, in Screw-End and Socket-Welding Types to meet your service requirements. Send today for Free Catalogs.



• *Process Liquid and Gas Piping*



• *High Pressure Lines*

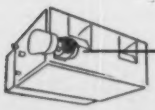
Bulletin A3-50—Forged Steel Fittings
Bulletin S-1-55—Stainless and Alloy Fittings
Bulletin U-1—Forged Steel Unions
Bulletin S-3-55—150 lb. Stainless Fittings

Sold Through Leading Distributors

WATSON-STILLMAN FITTINGS DIVISION
H. K. Porter Company, Inc.
Roselle, N. J.

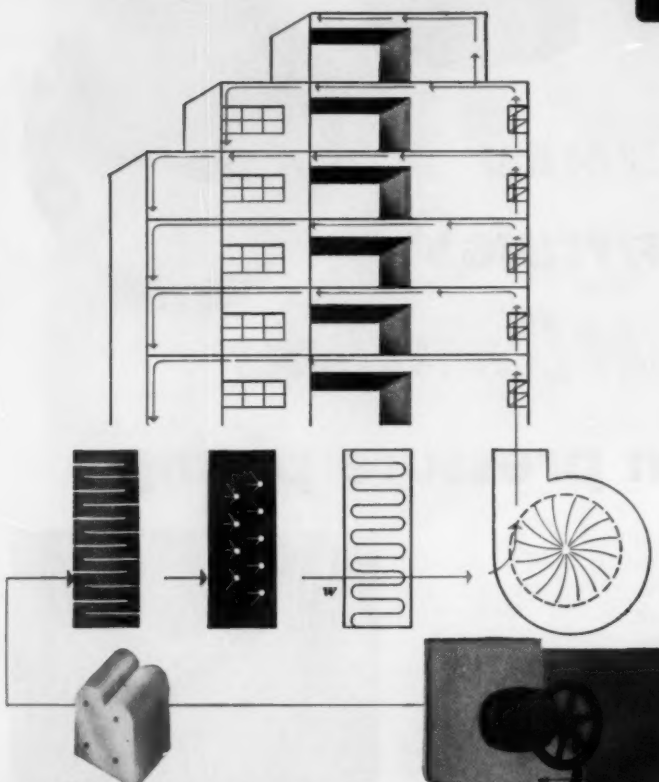
a better kind of power

for the **air conditioning** industry



The mark of an Extra Dependable machine

ED ELECTRO DYNAMIC



The red E.D. "power spot" on air conditioning equipment means *extra dependable* power, because E. D. motors are premium-built for *extra quiet* operation, without sacrifice of starting and anti-stalling capacity.

Investigate the superior performance of Electro Dynamic standard and special motors, gear motors and variable speed drives . . . 75 years in the making . . . yours today at *no extra cost!*

ELECTRO *Extra* **DYNAMIC** *ependable motors*

1 to 250 hp. AC and DC. Standard or special purpose. N.E.M.A. standards.

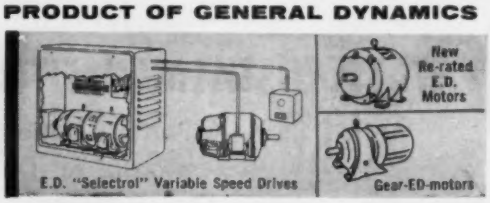
GD GENERAL DYNAMICS

PRODUCT OF GENERAL DYNAMICS

NEW...

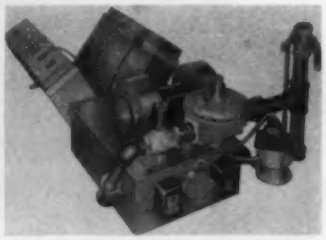
Write for Brochure 100 and literature on new E.D. motors and drives.

Electro Dynamic division of General Dynamics Corporation Bayonne, New Jersey



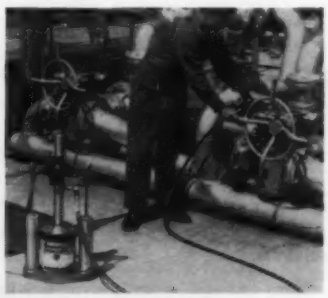
EQUIPMENT DEVELOPMENTS

Continued



Burner . . .

. . . for larger commercial, industrial installation—Hastings Air Control, Inc., Omaha. Forced combustion gas conversion type. In 16 sizes with capacities ranging 350,000 to 4,400,000 Btu input. Has adjustable flame angle to conform to boiler requirements. Burner design is said to provide faster heat transfer. Engineered for controlled, positive air and gas mixture for uniform combustion, quiet operation.



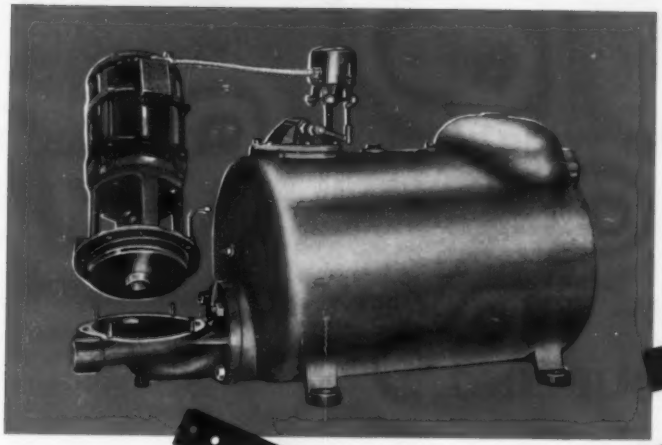
Valve Lubricant Gun . . .

. . . with compact, lightweight design for field and plant maintenance—Rockwell Mfg. Co., Meter and Valve Div., 400 N. Lexington Ave.. Pittsburgh 8. Positive self priming type, operates on air pressures to 150 psi. Recommended by company for large scale valve lubricating in refineries, compressor stations, gasoline plants, cycling plants, etc. Air motor and double piston construction provides self priming action.

Dehumidifier . . .

. . . featuring thermostatic control—Dryomatic Corp., Alexandria, Va. Adsorption type for use in factories, warehouses, storage vaults where controlled humidity desired. Is dual tower unit using silica gel as drying

Let's look into a SKIDMORE



TYPE "VC" CONDENSATION PUMP

• • • QUIET OPERATION

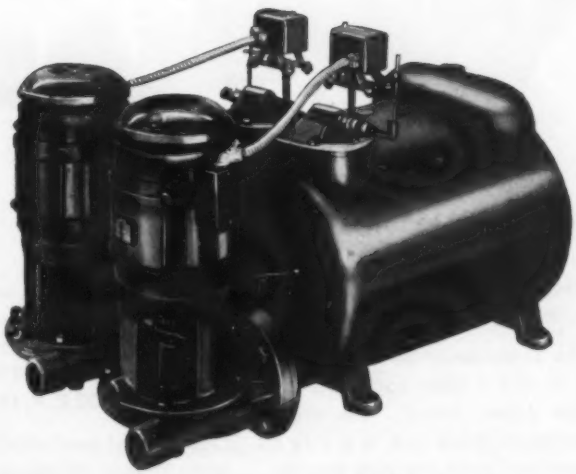
• • • LOW INLET CONNECTION

• • • ACCESSIBILITY WITHOUT DISTURBING PIPING

• • • STURDY CAST IRON

Contractors, engineers, architects — men who specify heating pumps, look to Skidmore for a dependable source. They know that in every Skidmore Pump is built years of service and dependability . . . they know that from past experience Skidmore has just the type and capacity for their job, regardless of installation requirements.

Add to this, the practically service-free performance — the sturdy balanced construction. Yes, look into a Skidmore Pump, and then you can see why Skidmore has been synonymous with quality pump engineering since 1921.



Type "VC" Condensate Pump (duplex unit shown above) is perfectly balanced to assure quiet, smooth operation. Capacities range from 1,000 to 65,000 sq. ft. E.D.R. Discharge pressures from 10 to 75 lbs.

Write for Bulletin No. 10-B on Type "VC" Pump

SKIDMORE PUMPS

SKIDMORE CORPORATION • ST. JOSEPH, MICHIGAN

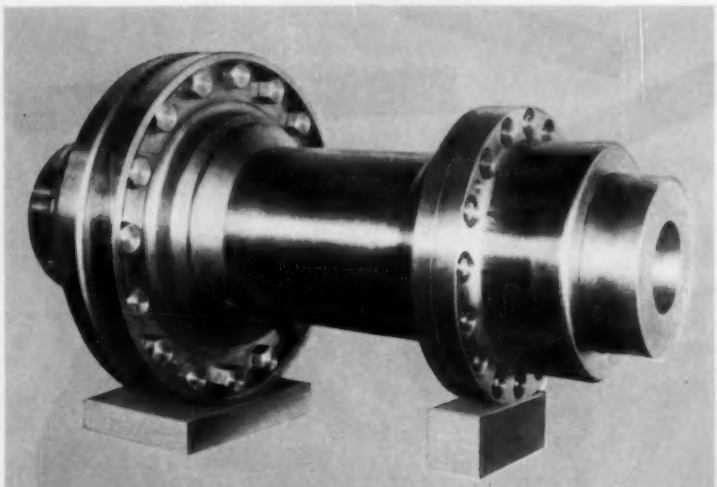
1800 lbs.

...is the weight

of this SPECIAL

forged steel insulated spacer

WALDRON GEAR COUPLING



Despite its size and weight, it is in perfect dynamic balance.

The compressor or driven end is a size 8 gear half with the hub taper bored. The main motor, or drive end, is a size 6 gear half with the hub straight bored. The forged steel spacer is 24" long.

The coupling will connect a 14,000 H. P. synchronous motor to an axial compressor. 18,000 maximum H. P. will be transmitted at 3,600 R. P. M.

This special insulated coupling is only one of many special units which we design and make.

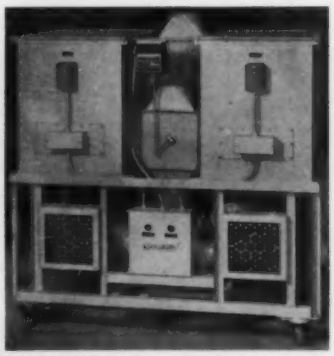
We invite your inquiries regarding couplings to successfully solve your particular problem. No obligation.

JOHN WALDRON
CORPORATION
New Brunswick, N. J.
Since 1827

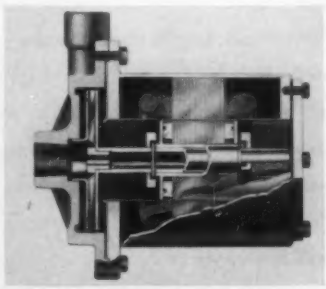
Sales Representatives In Principal Cities

EQUIPMENT DEVELOPMENTS

Continued



agent. Designed to maintain humidities as low as 10 percent in areas to 60,000 cu ft over wide temperature range. Thermostats control regeneration cycle, making machine self adjusting to atmospheric conditions, says company.

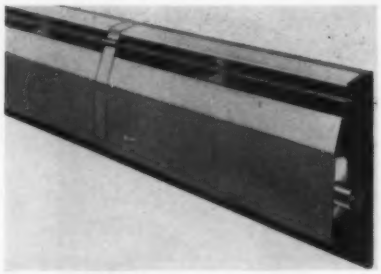


Centrifugal Pumps . . .

. . . with new construction methods, materials, cooling circuit—Chempump Corp., 1300 E. Mermaid Ln., Philadelphia 18. Sealless design. In capacities 1/3 to 3 hp. Parts fabricated with corrosion-resistant metals. Bearings offer 400 percent more bearing area, says company. For capacities to 170 gpm, heads to 150 ft. Temperature, pressure limits: 350 F, 150 psi.

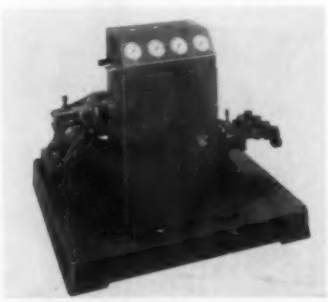
Pressure Relief Valve . . .

. . . line expanded by manufacturer—McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18. Includes single valves in ¾, 1, 1½ in. sizes; manifold type for larger hot water space heating boilers. Also available with higher opening pressures for domestic hot water tanks, heaters.



Baseboard Heating . . .

. . . with new heating elements, cover assembly—Slant-Fin Radiator Co., Richmond Hill, N.Y. Heating elements "BB-1" and "BB-2" augment company's standard baseboard units for steam, hot water heating systems. "BB-1" combines 1 in. nominal copper tube with aluminum fins for higher capacity output, says company. "BB-2" fabricated of 1 in. nominal copper bearing tube with steel fins. In 2, 2½, 3, 4, 5, 6 ft lengths. Cover assembly designed to enclose new elements. Components snapped into place. In 2½, 3, 4, 5, 6, 8 ft lengths.

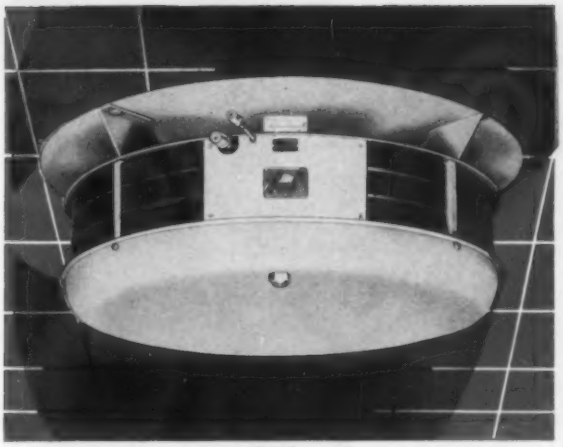


Controlled Volume Pump . . .

. . . uses 3 to 15 psi instrument air signal to adjust capacity—Milton Roy Co., 1300 E. Mermaid Ln., Philadelphia 18. For use in pneumatic process control systems. Designed to solve low capacity flow control problems. Utilizes air servo system with feedback loop designed to give capacity adjustment within 1 percent accuracy. Stroke length infinitely adjustable 0 to 100 percent of full length using reversible rotary air motor.

Centrifugal Chillers . . .

. . . for outdoor installation without protective enclosures —Trane Co., La Crosse, Wis. All sizes in 50 to 800 ton refrigeration capacity "CenTraVac" line have this optional feature. Purge unit, control panel, conduit boxes, capacity control mechanisms weatherproofed, provided with electric heaters to reduce condensation. Insulation is waterproofed. Weather-resistant paint used on exterior. Recommended by company for structures where equipment room space is at premium.



DOERR Motors
solve problem
on Bush
Jet Coolers

Ceiling Jet Unit Coolers, a product of the Bush Manufacturing Company, of West Hartford, Connecticut, have the responsible job of maintaining continuous low temperatures in cold storage rooms. This calls for reliable motor operation, usually in the presence of high humidity.

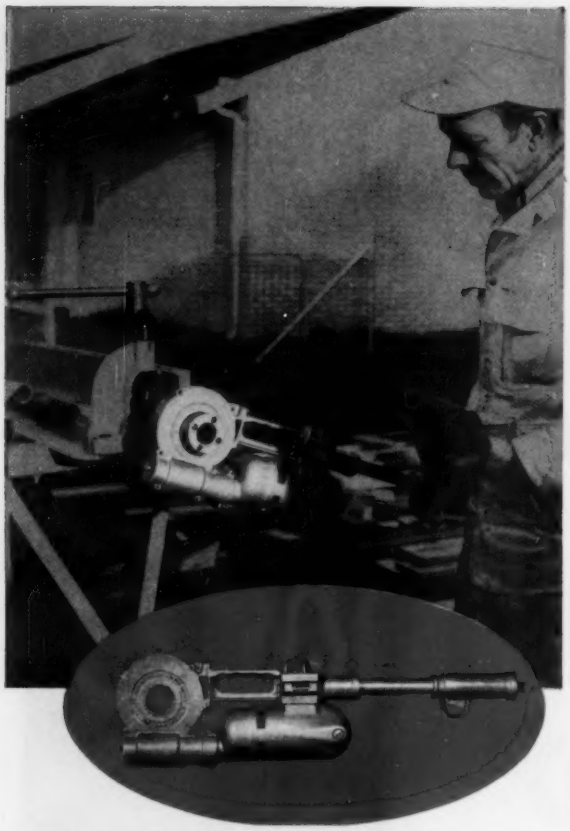
The Doerr 1/10 hp, 1140 rpm, Type C, permanent split capacitor motor selected had to be suitable for replacement in existing units in the field. The band mounting used restricts the frame diameter and height is also at a premium. The unusual method shown for mounting the capacitor provided the answer and has simplified assembly in both production and in servicing.

This is another instance where Doerr has helped with a special design. If you have an unusual motor problem, please let us hear from you.

YOU GET MORE with DOERR!

DOERR
Electric Corporation
CEDARBURG, WISCONSIN

Electric Motors from 1/30 to 5 hp. Standard or designed to your specifications.



Threads ¼" to 10" pipe in seconds—right on the job . . . the Lawco, Jr.

PORTABLE PIPE THREADER

Here's the amazing portable power tool that threads pipe in a vise, on a wall, in a ditch . . . practically any place you can take a power cord!

Light in weight (20 lbs.), the Lawco, Jr. eliminates the need for hauling heavy, bulky threading machinery to every job. All you do is position the Lawco, Jr. on the pipe, pull a trigger, and the cutting dies go to work for you. Lawco, Jr. is safe, and is easy to operate.

You can handle pipe from ¼" up to 10". The Lawco, Jr. is adapted for use with Ridgid OR dies for pipe up to 1" and with Ridgid 65-RC dies for 1" to 2" pipe. A square shank adapter drives standard cutting dies of larger sizes.

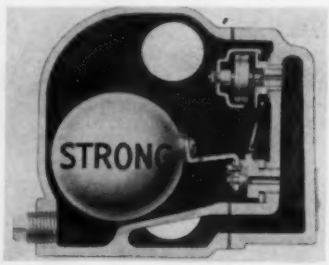
And pipe threading isn't all it can do. Below are other applications this versatile tool can handle for you, faster, better. Write for details.

Driving nuts and bolts. Portable winch . . . easily hoists 500 lbs. Threads pipe in walls, small spaces. Augering—vertical or horizontal.

VELOCITY POWER TOOL COMPANY

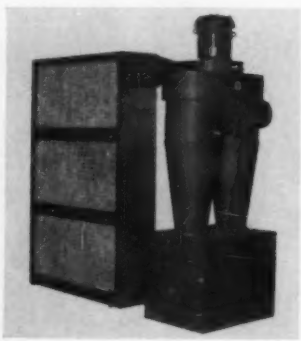
201 North Braddock Avenue, Pittsburgh 8, Pa.

EQUIPMENT DEVELOPMENTS — *Continued*



Steam Traps . . .

. . . of float and thermostatic design for air, condensate removal in low pressure steam systems—Strong, Carlisle & Hammond Co., 1329 W. Third St., Cleveland 13. Traps engineered for fast heating, efficient operation at pressures to 15 psi. Are said to prevent trap, connecting piping from becoming air bound. In operation, ball float expands to close outlet as temperature increases. Keeps valve closed until condensate level reaches predetermined height. In five sizes ¾ to 2 in. Capacities range 70 to 5750 lb per hr of water.

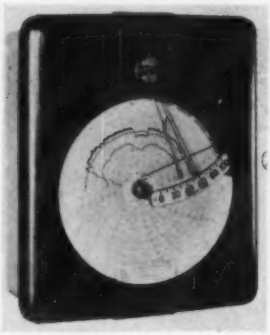


Dust Collector . . .

. . . with new after-filtering mechanism—Torit Mfg. Co., 287 Walnut St., St. Paul 2. Mechanism has six throw-away filters designed for effective filtration. Unit engineered to collect dust, lint, chips, powders, fumes in industrial plants. Recirculates filtered air back into room to cut down heat loss during cold weather. Has 5 hp, 3450 rpm motor that pulls 2100 cfm of air through 8 in. outlet at 3.0 in. of water gage.

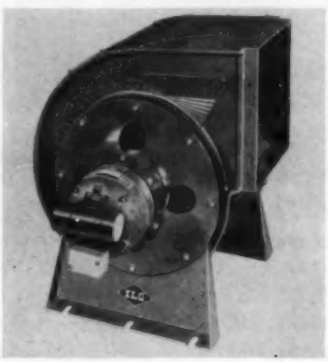
Air Operated Pilot . . .

. . . for pressure, temperature control—A. W. Cash Co., P.O. Box 551, Decatur, Ill. For pressure ranges 0-15 to 0-10,000 psi, 0-30 in. H_2O and 0-30 in. Hg vacuum. Temperature ranges −40 to 1000 F. Cited features: incorporation of process pressure or temperature gage in pilot, calibrated set point adjustment; unit construction; feedback proportional control with 1 to 100 percent proportional bank and differential gap, availability with proportional plus automatic reset action.



Receiver Recorder . . .

. . . for d-c type pickups, telemetering systems in steam and process plants, laboratories—Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10. May house as many as four plug-in, d-c receivers, or two receivers and two pneumatic controllers. Combines four records from d-c or a-c pickups or pneumatic transmitters on same circular chart. Receiver operates on potentiometric null balance principle, using electronic voltage reference instead of battery. Maintains performance at temperatures 40 to 120 F.



Centrifugal Fan . . .

. . . with airfoil blades designed to give greater efficiency, quieter operation—Ilg Electric Ventilating Co., 2850 N. Pulaski Rd., Chicago 41. Backward curved, all aluminum blade design produces freedom from air flow separation at normal working pressures, says company. Eliminates open vortex region on under side of blade. Fan operates to 13,500 fpm maximum tip speed. In six sizes with direct connected or belted drives.

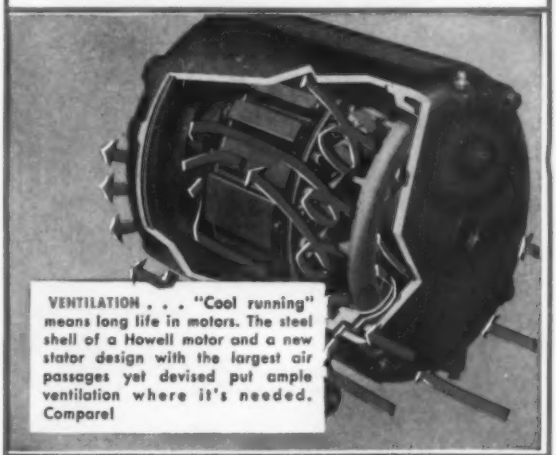
Welding Equipment . . .

. . . for hidden or submerged arc welding—Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17. New line includes welding heads, controls and adjustments, accessories, power sources. Company's line also includes electrodes for welding low carbon steel, alloy steels, stainless steel, and for hardfacing, and other equipment.

To AIR CONDITIONING ENGINEERS,
Howell suggests

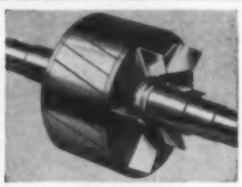
What to look for in Weather-Protected motors

Want pump or compressor motors with all the space and weight-saving advantages of the NEMA re-rated frame size plus labyrinth-type ventilation to make them truly weather protected? Below are some points for comparison and a few of the reasons why the new Howell "Series 100" motors are so outstanding!



VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell motor and a new stator design with the largest air passages yet devised put ample ventilation where it's needed. Compare!

BEARINGS . . . They should be fully protected. Dirt can't enter Howell's double shielded bearings either from inside or outside the motor, because they are sealed in the end plate cavities by dust-tight inner caps. Compare!



COPPER-CLAD ROTORS . . . Howell motors have copper-wound rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your special requirements. Compare!

New Series 100 motors are SMALLER • LIGHTER • COOLER • MORE STREAMLINED. Available in Weather-Protected, Open Drip-Proof (illustrated Left) TEFC, and Explosion-Proof enclosures.

Write for Bulletins N-100-E and WP-1

Precision-Built Motors for Industry Since 1915

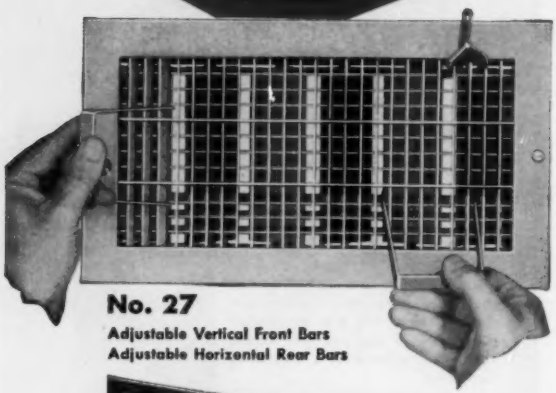
HOWELL MOTORS

INDEPENDENT

"Fabrikated"

REG U S PAT OFFICE

DOUBLE CORE REGISTERS
with opposed blade dampers
key control
For Commercial Installations



No. 27
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars

Rear View
Showing Volume
Control Dampers

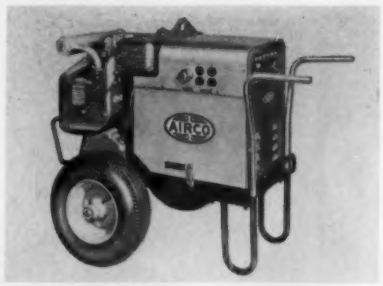
Write for Bulletin
No. 54-A which gives
complete details and sizes
up to 48"x 24"

Always Leading—
Always Progressing

THE INDEPENDENT
REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

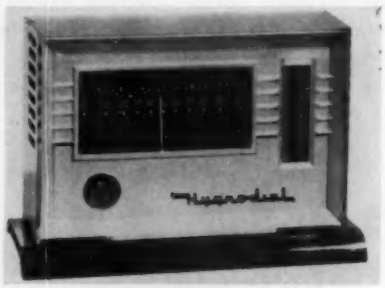
EQUIPMENT DEVELOPMENTS

Continued



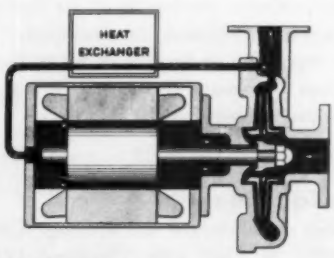
Arc Welders . . .

. . .for field production, maintenance—Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 60 E. 42nd St., New York 17. In two new engine driven models. For applications where 1/16 to 3/16 in. a-c or a-c/d-c electrodes used. Rated welding current is 200 amp, 100 cycle, single phase with 100 percent duty cycle. Current range is 15 to 200 amp. Besides welding, both models provide auxiliary power.



Indicator . . .

. . .for direct reading of humidity, temperature—Abbeon Supply Co., 179-25 Jamaica Ave., Jamaica 32, N.Y. "No. 187 Hygrodial's" humidity scale covers 0 to 100 percent relative humidity. Hair element with spring mechanism allows pointer to move across face of dial for rapid sensing of changes. Temperature scale covers 0 to 110 F. Is said to be accurate within 1 deg at 70 F, within 3 deg at extremes of scale.

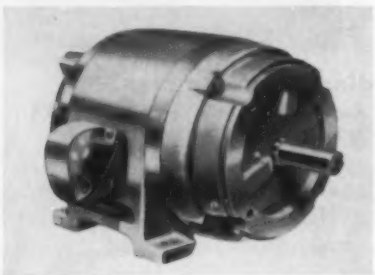


"Canned Motor" Pump . . .

. . .for high temperature liquids to 1000 F—Chempump Corp., 1300 E. Mermaid Ln., Philadelphia 18. Pumped fluid enters rotor chamber of combined motor pump.

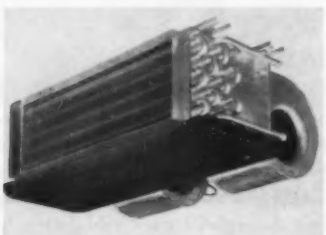
EQUIPMENT DEVELOPMENTS *Continued*

"Necked down" area between motor, pump sections provides thermal barrier, narrow restriction for passage of fluid. Secondary impeller mounted on rotor circulates rotor chamber fluid through water cooled heat exchanger. In sizes 5 to 7½ hp, ¾ and 1½ hp. Maximum head is 195 ft, maximum capacity 250 gpm.



Horizontal Motors . . .

. . . with face type mounting brackets for direct connection to driven equipment—U.S. Electrical Motors, Inc., Box 2058, Los Angeles 54. Built to rerated NEMA specifications. Designed for more horsepower in compact design. Fitted with either NEMA styles C or D brackets. Units in ratings 1 to 30 hp. Cited features: "Ventrifoil" deflectors direct air, deflect water; heat treated frame prevents warpage; windings asbestos protected.



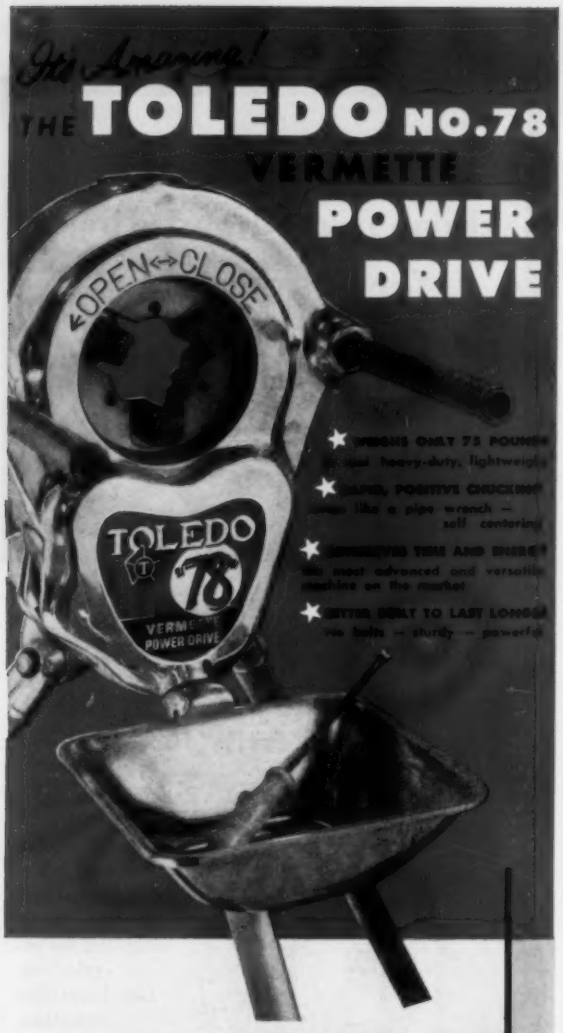
Air Conditioning . . .

. . . for individual rooms of multiroom structures—Drayer-Hanson, Inc., 3301 Medford St., Los Angeles 63. "Spot-aire LRC" available as basic unit or as concealed cabinet. Nominal capacities range 5000 to 24,000 Btu per hr cooling capacity, 15,000 to 60,000 Btu per hr for heating.

Gas Control Valve . . .

. . . for control of gas burners—Sullivan Valve and Engineering Co., Butte, Mont. "Adjusta-Flo" designed for unobstructed gas flow for increased capacity. Full circle valve closure swings open to allow flow to full valve capacity. Operation makes capacity greater than valve size rating, says company, reduces pipe size, valve size required. In 1, 1¼, 1½ in. sizes.

. . . You can't beat these drop-head dies for easy work, perfect threads . . . and long trouble-free service!
Every RIDGID Pipe Tool TESTED before shipment
RIDGID
Drop-Head Dies
for ⅛" to 2" pipe
Each size die head snaps instantly into ratchet handle. Dies reverse quickly for close-to-wall threads, easily removed for re-grinding. Left hand dies available.
00R, ⅛" to 1"
111R, ⅛" to 1¼"
12R, ⅛" to 2"
Carrier free with complete sets.
Every RIDGID Pipe Tool individually TESTED before shipment.
Buy them from your Supply House.
RIDGID
Work-Saver Pipe Tools
The Ridge Tool Company • Elyria, Ohio • U.S.A.



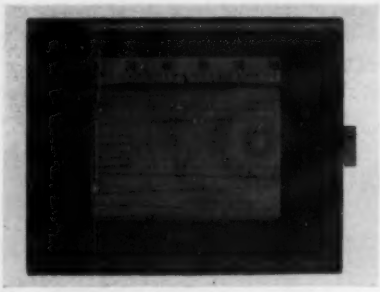
A time proved, PORTABLE power drive providing effortless cutting, threading and reaming of pipe and conduit . . . a worthy addition to "TOLEDO's" well known line of quality pipe tools. Fully guaranteed. Handles up to 2" sizes . . . grips, tightens and centers pipe automatically, forward or reverse. It's the lightest portable power drive of its kind. And remember . . . if it bears the "TOLEDO" label . . . you know it's a dependable product.

Write today for new free bulletin with conclusive proof of superiority. Your "TOLEDO" supplier has all the facts.

TOLEDO PIPE THREADING MACHINE COMPANY
TOLEDO 4, OHIO

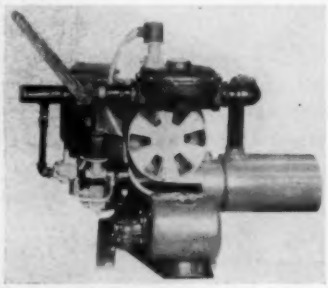
BUILDERS OF THE WORLD'S FINEST PIPE TOOLS®
TOLEDO
PIPE THREADERS • PIPE WRENCHES • PIPE MACHINES

RECENT TRADE LITERATURE *Continued*



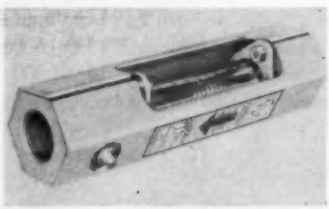
Recording Potentiometer . . .

. . . designed for full scale pen travel in 0.4 sec—Bristol Co., Waterbury, Conn. Makes traverse across 11 in. chart scale without overshoot at end, says company. "Deadband" is said to be less than 0.1 percent of full scale span. Offered with standard ranges low as 1 millivolt for full/scale, with source resistance to 10,000 ohms. Designed for recording rapidly changing variables in laboratory tests.



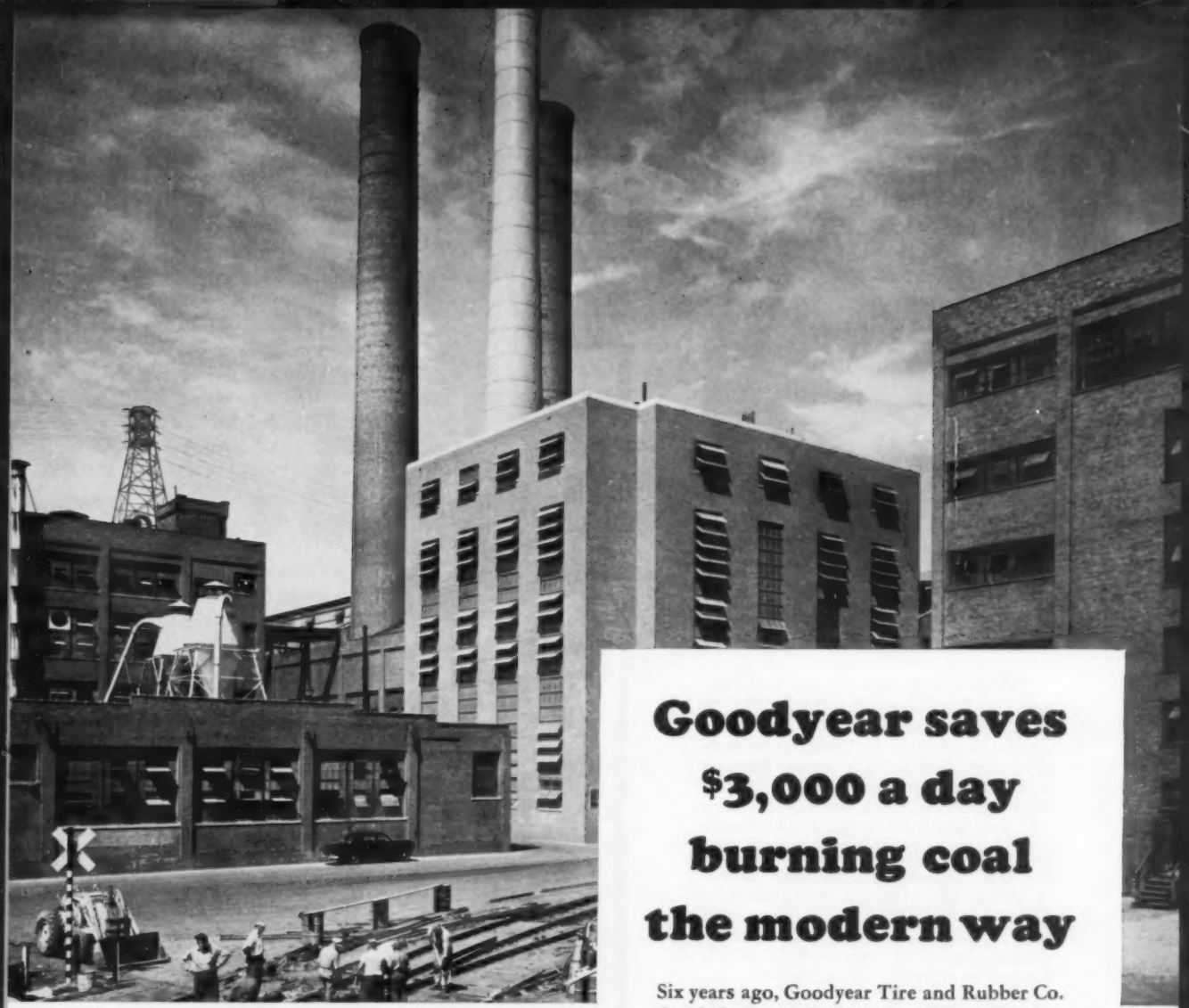
Industrial Gas Burners . . .

. . . for capacities 720,000 to 8,600,000 Btu—Cleaver-Brooks Co., Burner Div., 326 E. Keefe Ave., Milwaukee 12. For gas, No. 2 oil, gas or combination No. 5 oil and gas. Secondary air furnished by burner, so doesn't need stack draft. Oil, gas interchange done by flip of switch. Air controlled through damper modulating between high and low fire.



Flow Indicator . . .

. . . designed for balancing warm water heating, chilled water cooling systems—Bell & Gossett Co., Morton Grove, Ill. "Thermoflo Balancer" indicates water flow rate through circuits to 10 gpm. Has built-in valve to adjust flow rate to desired setting. Includes thermometer. Has other uses in various industrial fields, says company.



Goodyear saves $3,000 a day burning coal the modern way

Six years ago, Goodyear Tire and Rubber Co. decided to modernize its power service. Among other considerations, 70% of the firm's steam-generating equipment was over 30 years old. As a result, operating efficiency was only 65%. Power needs at Goodyear's Akron plants ran so much greater than capacity that additional power had to be purchased. Goodyear engineers and engineering consultants, Sargent & Lundy, were called in to study the problem and recommend a solution.

Now two 220,000 lb.-per-hr. boilers have replaced six 50,000 lb.-per-hr. units. Coal and ash handling are automatic. Controls are fully automatic. And not only have these and other changes resulted in dependable power service, but steam generating efficiency is now 82%—saving Goodyear $3,000 a day. For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D.C.

Consult an engineering firm

Designing and building hundreds of heating and power installations a year, qualified engineering firms can bring you the latest knowledge of fuel costs and equipment. If you are planning the construction of new heating or power facilities —or the remodeling of an existing installation—one of these concerns will work closely with your own engineering department to effect substantial savings not only in efficiency but in fuel economy over the years.

facts you should know about coal

Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems result in a virtually labor-free plant • Coal is the safest fuel to store and use • No dust or smoke problems when coal is burned with modern equipment • In most industrial areas, bituminous coal is the lowest-cost fuel available • Between vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and it's price remaining stable.

"For over 19 years Janitrol has given excellent heating performance" at CECO STEEL

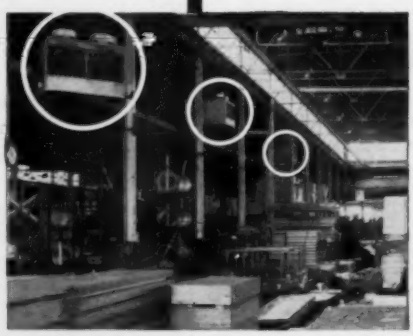
says
Mr. Hobart S. Peterson
Supt. of Construction
& Maintenance, Ceco
Steel Products Corp.

"We originally selected our first Janitrol Gas-Fired Unit Heaters in 1936 to eliminate the need for a central boiler system, large stack and continuing operation and maintenance costs. Because of their excellent performance record, we have continued to specify Janitrols wherever possible," states Mr. Peterson.

Ceco Steel's experience is not unusual. Janitrol's performance has been proved in thousands of commercial-industrial heating applications. With over a million Janitrol heat exchanger tubes installed since 1940, less than ¼ of 1% have been replaced for any cause!

If you're building or modernizing, investigate the advantages of unit heating with your Janitrol engineer-installer. He's listed under "Unit Heaters" in the yellow pages of your phone book.

MORE INFORMATION?
Write for our selection of 18 case histories. Ask for No. JS-226, "Quick Facts". *It's Free!*



The Ceco production area is heated by suspended Janitrol Unit Heaters. They occupy no floor space . . . do not interfere with production.

Janitrol GAS-FIRED UNIT HEATERS

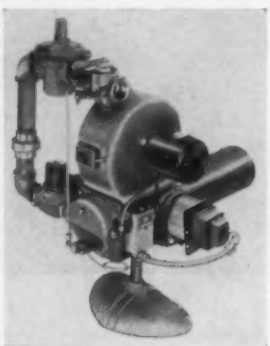
Janitrol Heating & Air Conditioning Division
Surface Combustion Corporation, Columbus 16, Ohio
In Canada: Alvar Simpson Ltd., Toronto 13

ALSO MAKERS OF *Surface* INDUSTRIAL FURNACES AND *Kathabar* HUMIDITY CONDITIONING

EQUIPMENT DEVELOPMENTS
Continued

Couplings, Adapters . . .

. . . for use with polyethylene pipe—Wilmington Plastics Co., 810 W. Heald St., Wilmington, Del. Injection molded from rigid unplasticized polyvinyl chloride. Are said to be corrosion-resistant, to form tight joint without setting up undue compressive stress. Couplings (polyethylene to polyethylene bottom), adapters (polyethylene to metal top) in ¾, 1 in. sizes. Will ultimately be available in sizes to 2 in., company reports.



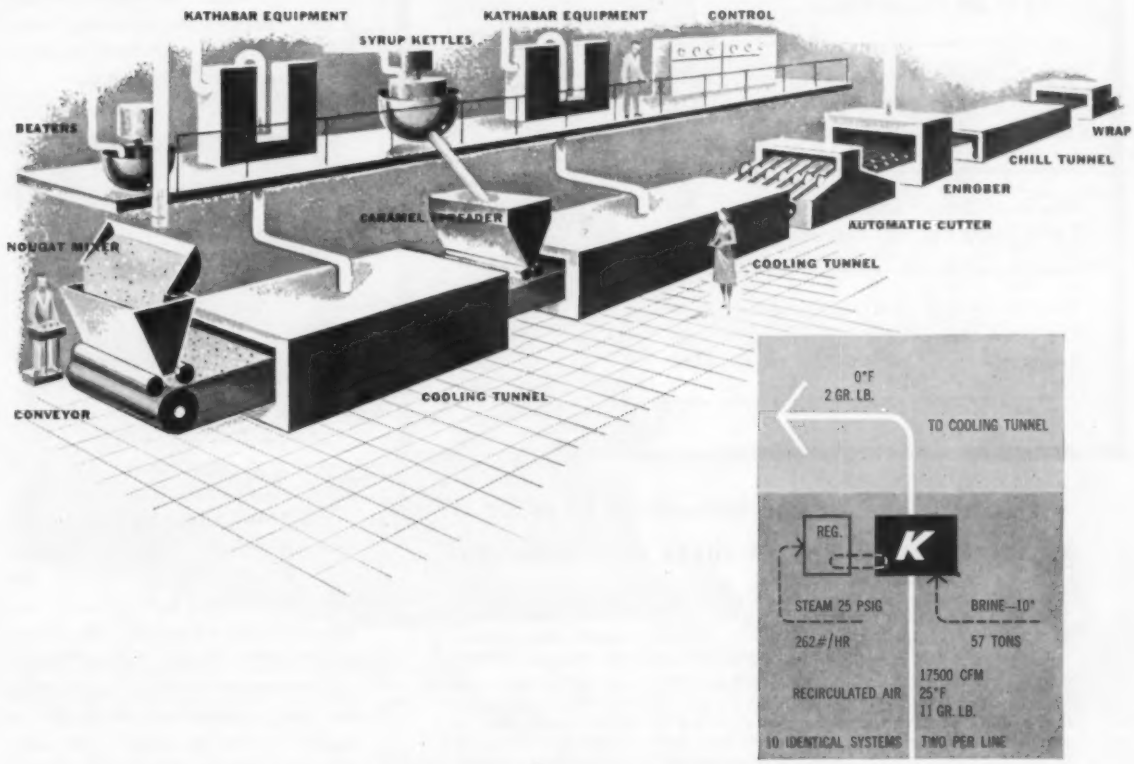
Gas Burner . . .

. . . with 70,000 to 370,000 Btu input—Hastings Air Control, Inc., Omaha. For natural, LP, mixed gases. Ignition takes place before blower comes on. This results in quieter ignition, elimination of centrifugal switch, says company. Unit designed for uniform air, gas mixture.

Return Air Grille . . .

. . . with extended baseboard design, maximum free area—Lima Register Co., Lima, Ohio. In 4 ft, 2 ft sizes with 52.5 and 26.6 sq in. free areas, respectively. Is companion piece to manufacturer's extended baseboard

Dry air cuts bar-cooling time 98.7%



Kathabar humidity conditioning cut bar-cooling time from 16 hours to 12 minutes for one of the world's largest candy manufacturers. The company now has an economical continuous process in place of a once laborious and costly batch operation.

The chemical absorbent in the Kathabar unit removes the air moisture that would cause frost, condensation, and the troubles they create. Air temperature is regulated by the unit's coolant. Dependability of the system is proved by its continuous operation, delivering air at 0°F for 7 years.

Other candy makers have applied the Kathabar system with equal success to drying, polishing, coating, bottoming, and packaging processes. You'll find that dry air, delivered to your order by Kathabar humidity conditioning, is a profitable investment.

write for complete confectionery story today

Kathabar®
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

BARBER COLMAN

Wheelco Flame-otrols

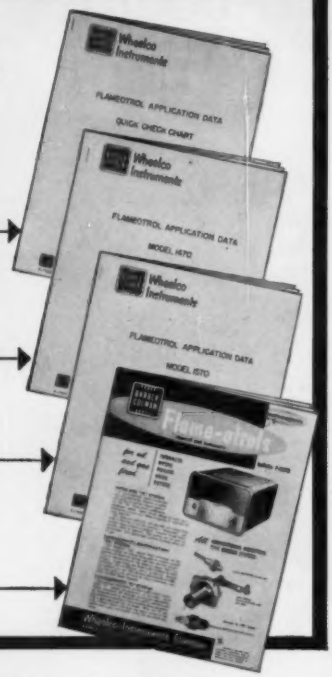
FREE AUTHORITATIVE DATA FOR ENGINEERS WHO SPECIFY COMBUSTION SAFEGUARDS

No. 1—Flame-otrol Application Data, Quick Check Chart

No. 2—Flame-otrol Application Data, Conductivity-Rectification System

No. 3—Flame-otrol Application Data, Infrared "IR" System

No. 4—New Flame-otrol Catalog describes Controls, Sensing Systems, and Control Centers



If you make or use industrial heating equipment, you'll want these new booklets!

Complete flame supervision, no matter what the type of fuel, is available from Wheelco's broad line of industrial electronic combustion safeguard systems. Flame-otrol units can be applied to oil- or gas-fired furnaces, ovens, boilers, kilns, and driers with any type of conventional industrial sensing element.

Booklets offered above describe the flexibility of application possible with Wheelco Flame-otrol units and show how these units have been engineered to the job of flame detection and control. Years of research in the field of combustion safeguards have resulted in the engineering features now contained in the Flame-otrol system. Contributing to dependable performance of these systems are such features as: compact, plug-in design; heavy-duty construction; safety-type terminal strip; standard electronic tubes; and convenient checking strips.

Call your Wheelco field engineer for assistance in designing and specifying combustion safeguard systems.

NEW WHEELCO FLAME-OTROL

Wheelco Flame-otrols bring many improvements, including "plug-in" chassis, new safety-type terminal strip, "safe-start" operation, and convenient external test points to simplify circuit and voltage checking. Available with all conventional industrial-type sensing systems for improved flame supervision with gas, oil, or combination gas-oil firing. Bulletin F-6570.

WHEELCO INSTRUMENTS DIVISION

Barber-Colman Company

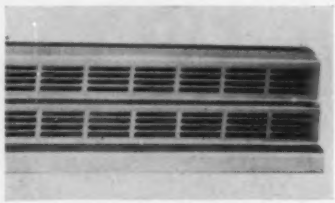
Dept. V, 1501 Rock Street, Rockford, Illinois

BARBER-COLMAN OF CANADA, Ltd., Dept. X, Toronto and Montreal, Canada

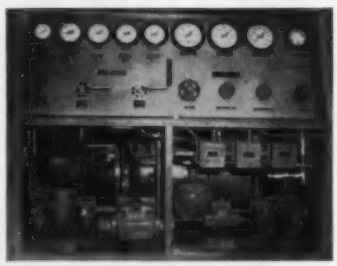
Industrial Instruments • Automatic Controls • Air Distribution Products • Aircraft Controls • Small Motors
Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

EQUIPMENT DEVELOPMENTS

Continued

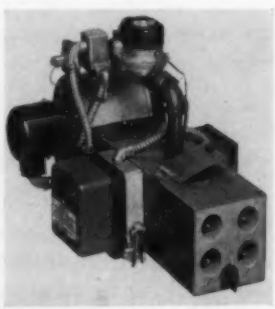


diffuser with automatic pushbutton damper control, baseboard diffuser without damper for economy installations. May be assembled in multiples using joining connector.



Booster Compressor . . .

. . . designed to supply large quantities of high pressure gas, free from oil, contaminants—Haskel Engineering and Supply Co., Glendale, Calif. Multiple stage hydraulic helium type. Has low piston velocity for operation without lubrication in applications where contamination of gas undersirable. Utilizes several stages of compression within pump. Gas can be repressurized efficiently to higher pressures within one compressor, says company.



Gas Burner . . .

. . . operating with air from low speed fan or natural draft—Mettler Co., Inc., Div. of Eclipse Fuel Engineering Co., 4366 Worth St., Los

BARBER COLMAN

ELECTRIC Automatic Controls

for low-cost, remarkably flexible control of MULTIPLE – ZONE air conditioning systems!

Rarely does a single building have the many varying temperature requirements of a medical center. In this new five-story Park-Chester Medical Building, for example, there are 54 zones for the 32 suites occupied by physicians and dentists. Many of the suites have an inner and an outer zone so outside treatment rooms can be kept warmer than inside waiting and consultation rooms. Heating and air conditioning must be controlled to meet the different needs of laboratories, X-ray rooms, lobbies, lavatories, reading rooms, secretarial spaces. To complicate the problem, this building owner permitted tenants to custom design their own suite layouts before construction started, so room sizes and types vary.

Park-Chester Medical Bldg., Cleveland, has multiple-zone, year-round air conditioning system. *Architect:* SAMUEL K. POPKINS. *Heating & Air Conditioning Contractor:* REFRIGERATION SALES CORPORATION, Carrier Distributor for Northeastern Ohio. *General Contractor:* WILLIAM PASSALACQUA BUILDING CO.

Nursery-rhyme figures (left) on gay pastel walls intrigue both parents and children who are waiting for attention in office suite of two pediatricians.

Surgeon's waiting room (right) has warm-looking wood paneling, comfortable modern furnishings, an inviting, home-like atmosphere.

How Barber-Colman can help you solve medical building problems . . .

So outstanding were the results of the control system developed for this Park-Chester Medical Building that the same techniques were specified for other medical centers in Cleveland listed below. And this same automatic control system is being used extensively throughout the country with multiple-zone, blow-through fan units for year-round air conditioning of several zones or different floors of the same building. Using steam or hot water, and chilled water or direct expansion coils, the one compact unit supplies conditioned air in varying degrees to each zone, automatically adjusted according to season, internal loads, solar exposure, and requirements of occupants. Only with the speed, flexibility, and positive operating characteristics of electrical components are these satisfactory results possible. Let us help you custom-tailor installations to individual needs—see your nearby Barber-Colman application engineers or write us.

LITERATURE KIT — get literature kit showing complete array of electric controls available for multiple-zone systems. See how "Control Centers" provide the finishing touch to an advanced, simplified technique

"CONTROLS BY BARBER-COLMAN" is becoming a by-word in multiple-zone air conditioning installations in large or small buildings in the Cleveland area. These include:

Garfield Hts. Medical Building
Parma Medical Building
Shaker Hts. Medical Building
Shaker Medical Building
University Medical Building

Barber-Colman Company

DEPT. V, 1301 ROCK ST., ROCKFORD, ILLINOIS, U. S. A.

Field Offices in principal cities

Automatic Controls • Air Distribution Products • Industrial Instruments
Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

GAS-FIRED UNIT HEATERS

by Modine

save you money right from the start

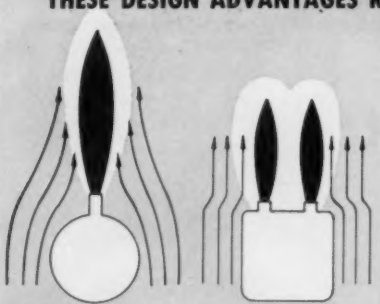
Lightweight cuts shipping, installation costs

WEIGHT COMPARISON

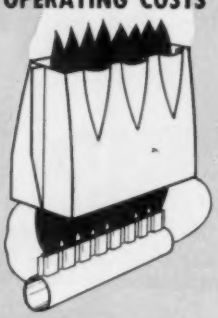
Brand	Capacity (Btu/hr. input)	Approx. Net Weight
Modine (aluminized steel)	105,000	105
Modine (stainless steel)	105,000	95
Brand "A"	100,000	170
Brand "B"	102,000	196
Brand "C"	90,000	175
Brand "D"	100,000	165
Brand "E"	100,000	210
Brand "F"	100,000	210
Brand "G"	105,000	170

Light weight, without sacrifice of strength or efficiency, makes Modine Unit Heaters easier to handle, faster to install. Also cuts need for expensive support structures.

THESE DESIGN ADVANTAGES REDUCE OPERATING COSTS



More usable heat per fuel dollar
Single-row burner ports help insure adequate secondary air supply. As a result, you get maximum combustion efficiency, more delivered heat per fuel dollar.



Faster, more uniform heating
Continuous flame from front to rear of individually-fired exchangers, increases radiant heat absorption, uniformly distributes heat through tube.

LONGER LIFE . . .
AND . . .
LOW-COST SERVICE

Stainless steel slashes corrosion loss
Modine burners, to all practical purposes, are unaffected by acid corrosion, rusting and scaling . . . give you many years of trouble-free, top efficiency.

GU-1270

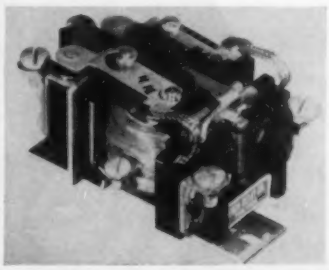
NEW 12-PAGE BULLETIN 655
gives you more complete information, selection and application data. Call the Modine representative listed in your classified phone book. Or write — Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wisconsin.

Modine
UNIT HEATERS

EQUIPMENT DEVELOPMENTS

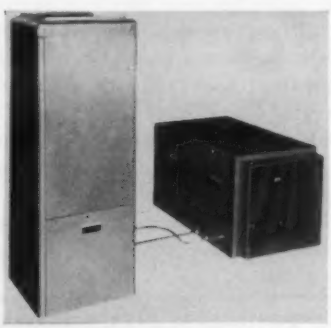
Continued

Angeles 63. For conversion of small boilers, furnaces, process heating equipment. Bronze or stainless steel jets can be replaced to boost, reduce Btu input within wide range. Specifications include assembled motorized mechanical draft automatic burner, with multiple removable-type orifices, four-port, low pressure manifold, one piece refractory facing. Combustion air supplied by low pressure, nonoverloading fan.



Motor Controller . . .

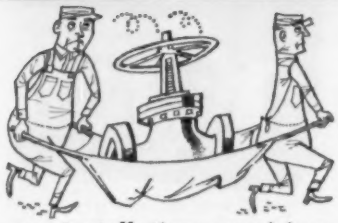
. . . with two-pole, magnetic design for industrial application—Leach Corp., Relay Div., 5915 Avalon Blvd., Los Angeles 3. Features small size, quiet operation, low coil power, screw terminal connections for simple installation. For normally open operation. Motor load ratings are for 1½ hp at 115 volts, 3 hp at 230 volts, a-c. Maximum contact load ratings are for 20 amps at 115 or 230, single phase, 114 amps locked rotor at 230.



Cooling Units . . .

. . . in 2, 3 ton air cooled, water cooled commercial models—Perfection Industries, Inc., 7609 Platt Ave., Cleveland 4. In eight models for in-

What's your
GATE VALVE
MORTALITY



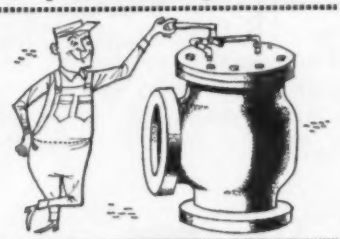
on installations requiring frequent opening and closing?

REPLACE *them*
with **G-A FLOWTROL VALVES**

✓ *Use the Angle Body and Save the Price of an Elbow Fitting*

✓ *Built to Last a Lifetime*

✓ *Operates with Finger Pressure*



HERE'S PROOF:
One of America's large railroads had a 6″ gate valve installation that operated on the average of 55 times a day. In addition to frequent repairs, this valve had to be entirely replaced every 3 months.

In the Fall of 1947, this valve was replaced with a 6″ G-A Flowtrol Valve. Now—more than 7 years later—this valve is still operating perfectly and not one parts replacement has been made!

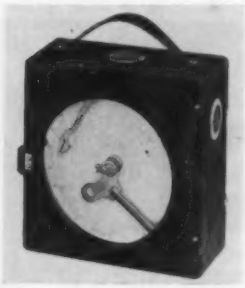
Want to know more about this unique valve? Write for Bulletin W-8A today.

GOLDEN ANDERSON
Valve Specialty Company
1210 RIDGE AVE., PITTSBURGH 33, PA.
Designers and Manufacturers of
VALVES FOR AUTOMATION

EQUIPMENT DEVELOPMENTS

Continued

stallation where spot cooling needed. Use propeller type fans. Designed to dehumidify, deliver clean, filtered air. Shown is 3 ton air cooled model.



Temperature Recorder . . .
. . . with high sensitivity bimetal actuated minature design for trucks, railway cars, other areas—Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5. Engineered for quick range changing, accurate operation in any position. Constructed to resist severe service met in modern transportation. For —40 to 140 F, in 50, 100 deg included spans. Manufacturer cites ease, speed of operation as outstanding feature.

Part Winding Motor . . .
. . . for use with magnetic increment starters to reduce starting shock to machines, minimize line disturbances, meet power company requirements for limited current inrush—Howell Electric Motors Co., Howell, Mich. For two-, three-step starting; 5 to 200 hp.

Program Control Switch . . .
. . . for automatic fuel burning systems with motorized draft inducers—Cleveland Fuel Equipment Co., 1111

COOLING WITH STEAM

C. H. WHEELER STEAM JET EJECTORS

In most cases if a process steam system is large enough for heating in winter, it can be used economically to provide air conditioning in the summer, because the increased steam load costs less per pound than the part load for process alone. A C. H. Wheeler Steam Jet Ejector system becomes most economical when air conditioning requirements exceed 100 tons. By means of this system water is chilled to as low as 50-55°F. with steam pressure of 50 psi or over. C. H. Wheeler has always led in the development of the steam jet ejector and its application to industrial refrigerating requirements. We invite your correspondence.

(Catalog 1462 is available.)

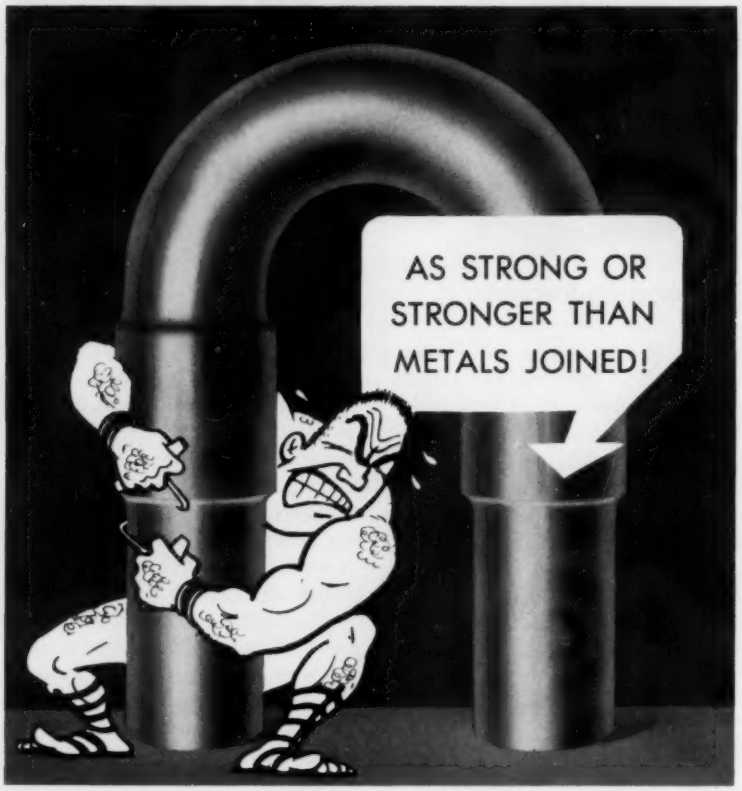
Note: In many areas utilities offer an attractive street steam rate in summer, which makes the steam jet ejector system economical for air conditioning large commercial and public buildings.

WE-509

C. H. Wheeler
of Philadelphia
19TH AND LEHIGH AVE., PHILADELPHIA 32, PA.

Joining Metals?

Then **BRAZE** *Them For Super-Strength!*



With L.T. PHOSON & SILBOND*

It's a fact! L. T.* brazed joints properly designed are as strong or stronger than the metals joined . . . and they stay that way!

Plus the strength factor, Phoson and SilBond L. T.* brazed (stress free) joints have high electrical and thermal conductivity, excellent resistance to corrosion . . . they eliminate finishing costs and give overall maximum economy.

Send us a part you have been joining by some other method. We'll test braze it for you and give you a per-part time and material analysis.

If you're joining metals, you'll decide, as so many others have, to L. T.* braze with Phoson and SilBond.

Ask for PHOSON - SIL BOND Booklet.

*Low Temperature

UNITED WIRE & SUPPLY CORPORATION
Brazing Alloy Division • Providence 7, R. I.
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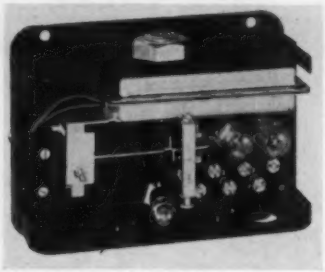
Contact Your Welding Supply Distributor

UNITED *LOW TEMPERATURE* BRAZING ALLOYS

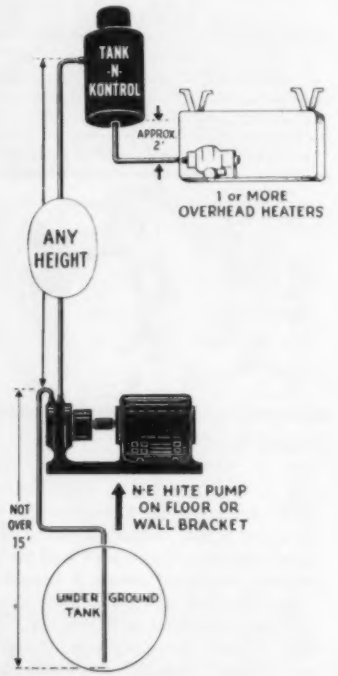
Permanently United

EQUIPMENT DEVELOPMENTS

Continued



Brookpark Rd., Cleveland 9. Designed to provide timed prepurge period, protection against draft failure without shutdowns. Operates on 115 or 230 volts, a-c. Terminals provided for remote signal or alarm.



Oil Lifting Unit . . .

. . . designed to raise fuel oil to any height for use in overhead heaters—N. E. Hite Mfg. Co., 303 N. Elizabeth St., Chicago 7. Consists of pump and "Tank-N-Kontrol." Operation governed by two mercury switches which control two sets of floats. One set maintains oil level in feed tank, stopping pump if oil line broken or tank runs dry. Other set stops pump in case main set fails to cut off at high level.

EQUIPMENT DEVELOPMENTS

Continued

Equipment Briefs . . .

ELECTRICAL CONTACT BURNISHER designed for mild, controlled abrasive action—Adre Co., Box 38, Hales Corners, Wis. Fitted in pen type case. Removes minimum of contact metal. Decreases frequency of cleaning.

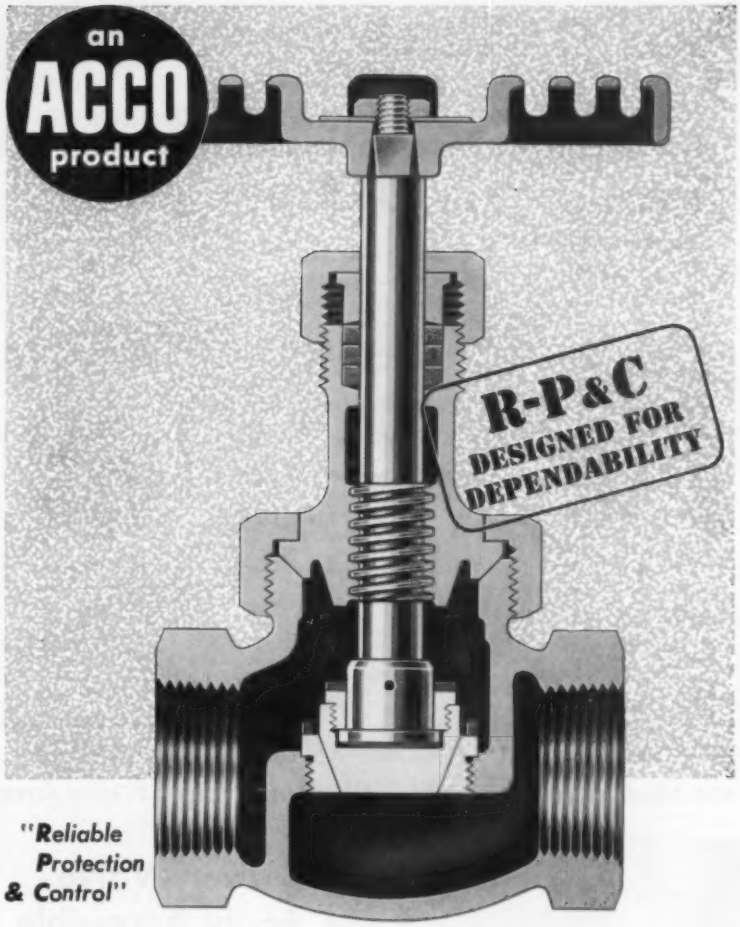
GLASS FIBER FILTER CARTRIDGE designed to fit standard filter containers—Porous Plastic Filter Co., Inc., 30 Sea Cliff Ave., Glen Cove, N. Y. "Glas-Kleer" throwaway cylinders offered in 2, 10, 25, 50 micron grades. Glass fiber cloth lining designed for lint free filtration.

PROPELLER FAN BLADES engineered for high air volumes against static resistances—Bronson Fan Mfg. Corp., 4560 Worth St., Los Angeles 63. "Hi-Static" series has blade design with six overlapping blades to give high ratings at reduced fan depth. In several diameters.

LABORATORY TEST GAGES available in new series—U. S. Gauge, Div. of American Machine and Metals, Inc., Sellersville, Pa. In 4½, 6, 8½ in. sizes, are designed to grade AA test gage accuracy. Ranges 15 to 20,000 lb makes gages suitable for replacing or augmenting deadweight testers or manometers.

ENCLOSURE for cast iron baseboard radiation—Crane Co., 836 S. Michigan Ave., Chicago 5. Conceals valve control. Features snap-on cover panel, valve with hinged handle that pulls to horizontal position for adjustments and flips to vertical within enclosure. Design eliminates screws, bulges, protruding handles, says company.

GLASS BLOCK, designed to reduce glare and heat, now in two



New R-P&C Bronze Globe Valve

—STAINLESS STEEL SEAT AND DISC (500 BRINELL)
—FULL-PLUG FOR CLOSER REGULATION, LONGER LIFE

R-P&C's new **Fig. 427-DP** bronze globe valve is recommended for steam, water, oil and gas service where control or regulation of flow is required. Its 500 Brinell stainless steel seat and disc resist wire-drawing—make it particularly suitable for continuous throttling and other severe applications.

• The Fig. 427-DP is packed with the quality features that users expect from R-P&C. For example, the union bonnet for added strength and convenience, and a disc and seat ring construction which permits regrinding without removing the valve from the line. The full-plug construction, with its exceptional wide seating surface, gives closer control, longer life.

• The Fig. 427-DP is rated for 300 lbs. Steam—1000 lbs. OWG in sizes ¼" to 2", and 600 OWG in sizes 2½" and 3". Also supplied as an angle valve. Precisely designed, it is a fitting addition to R-P&C's complete line of bronze valves—gates, globes, angles and checks, in pressure classes from 125 to 300 lbs. See your R-P&C Distributor or write for catalog.

ACCO

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

FOR FLEXIBLE CONNECTIONS IN

● DUST COLLECTION ● FUME CONTROL
● AIR-CONDITIONING ● MATERIALS HANDLING

PORTOVENT® ◀◀◀ USE ▶▶▶ FLEXAUST®

Spiral wire reinforced
DUCT

Sizes 3" to 36" ID Wide Pitch type RETRACTABLE

Flexaust hoses and Portovent ducts are made with strong cotton or nylon fabrics, impregnated and coated with neoprene compounds. Seams are fully bonded. Other important features are—

- ✔ EXTREME FLEXIBILITY
- ✔ AIRTIGHT — STRONG
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Sizes 1¼" to 36" ID Close pitch type

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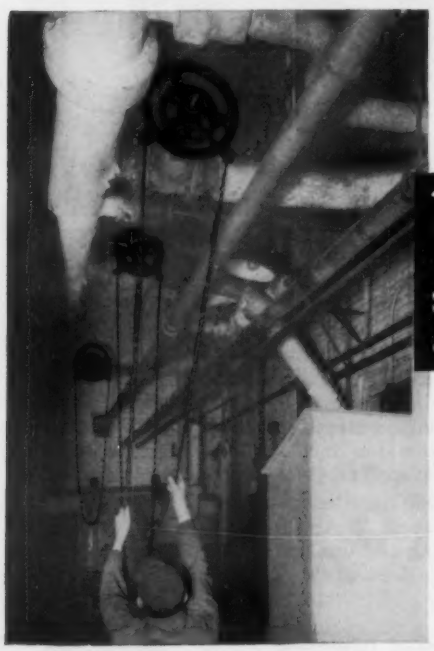
Bulletin #41 — Accessories and Installation Data
Bulletin #42 — Technical data on products and service.
Bulletin #43 — Application data and type selector guide.
Bulletin #44 — Friction loss data.
Prices lists.

THE FLEXAUST COMPANY, Dept. HP-10

100 PARK AVENUE NEW YORK 17, NEW YORK



Every Valve Easily Accessible with

Babbitt
—Adjustable—
SPROCKET RIM
with Chain Guide

NEWLY REDESIGNED for greater strength—easier, quicker, more solid assembly.

- **Simplifies pipe layouts**
- **Fits any size valve wheel**
- **Prevents accidents**

Your supplier carries complete stocks. Call him — or write for details and prices.

Babbitt STEAM SPECIALTY CO.

8 BABBITT SQUARE, NEW BEDFORD, MASSACHUSETTS, U. S. A.

EQUIPMENT DEVELOPMENTS

Continued

sizes—Pittsburgh Corning Corp., 1 Gateway Center, Pittsburgh 22. "Suntrol" available in 8 in. size as well as 12 in. Is incorporated with same pale green fibrous glass diffusing screen.

ELECTRIC HACK SAW for heavy duty service—Key-Hak Div., Producers and Distributors, Inc., 1321 Hanover Ave., Allentown, Pa. Self powered, portable type. Designed to make straight, circular, random cuts in building materials. Useful for cutting opening for duct-work, piping alterations, says company.

VANE RUNNERS coiled in 100 ft lengths—Elgen Mfg. Corp., 41-34 39th St., Long Island City 4, N. Y. Metal emerges from container at bench height. Manufacturer cites less waste, easy storage, easy handling as advantages.

ELECTRODE KIT with two improvements—Scully Signal Co., Melrose, Mass. Vertical lines to gage itself provide choice of setting by inch measurement as well as by degree angles. Large brass knob permits easy positioning of gage on burner nozzle.

DEHUMIDIFIER designed for drying small volumes of compressed gases to sub-zero dewpoints—Industrol Corp., Roselle Park, N. J. "Midget Dryer" in three sizes. Electrically regenerated. Of compact design for wall or bench mounting.

PORTABLE BAND SAW designed to cut through stainless steel, carbon tool steel, nickel, high speed tool steel —Porter-Cable Machine Co., 59 Exchange St., Syracuse 8. "Porta-Band" is lightweight, can be used in any position, says company. Blade available in 6, 9, 12, 16 teeth per in. sizes.

DITCH TAMPER for backfill tamping in ditches as narrow as 10

EQUIPMENT DEVELOPMENTS

Continued

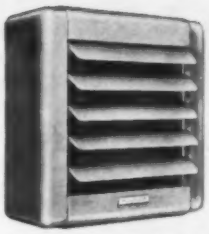
in.—Thor Power Tool Co., 175 N. State St., Aurora, Ill. Operates at grade level in ditches to 5 ft deep due to adjustable handles.

ASSEMBLY UNIT for fastening hubs to shafts without splines or keyways — U. S. Automatic Corp., Amherst, Ohio. "Gripspring" provides assembly without clearances, says company. Is wedged between hub and shaft under heavy pressure. Outer ring expands, inner contracts. Assembly consists of straight cylindrical shaft and hub bore to eliminate stress concentrations, permit tolerances on simple cylindrical surfaces, says company.

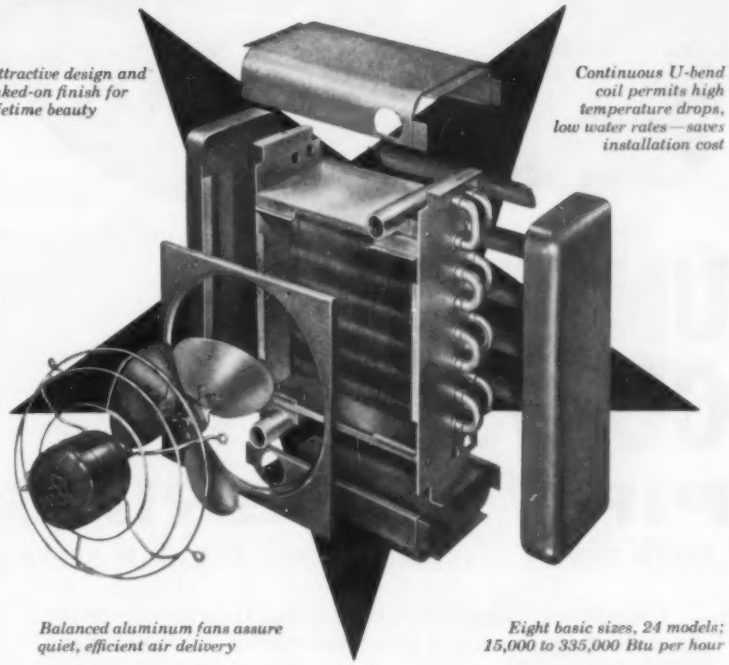
SCREW ANCHORS with self expanding design—Mastercraft Plastics Co., Inc., 95-01 150th St., Jamaica 35, N. Y. Made of tenite plastic, weigh less than metal anchors. Available for all screw sizes, lengths.=

STRIKE BACK!

Give to
AMERICAN CANCER SOCIETY



The five main points to this
new Nesbitt star



Attractive design and baked-on finish for lifetime beauty

Continuous U-bend coil permits high temperature drops, low water rates—saves installation cost

Balanced aluminum fans assure quiet, efficient air delivery

Eight basic sizes, 24 models; 15,000 to 335,000 Btu per hour

1. *Double utility* . . . from each size unit, a comparable range of capacities is available with either steam or hot water.
2. *Space-saving* . . . Nesbitt Propeller Fan Unit Heaters are the smallest, in physical size, for comparable Btu output.
3. *Flush-to-ceiling* mounting is permitted by the convenience of coil connections extending through the rear of the casing.
4. *Sealed-for-life* motor bearings on most of the unit models are but one of the many features making for long service.
5. *Rated quietness* . . . all units are tested and rated within the lowest classifications of the new I.U.H.A. Sound Code.

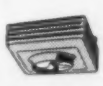
For a fuller description, send for Publication 401.

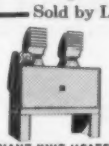
THE NAME TO GO BUY IN UNIT HEATERS

Nesbitt

Made by John J. Nesbitt, Inc., Philadelphia 36, Pa.

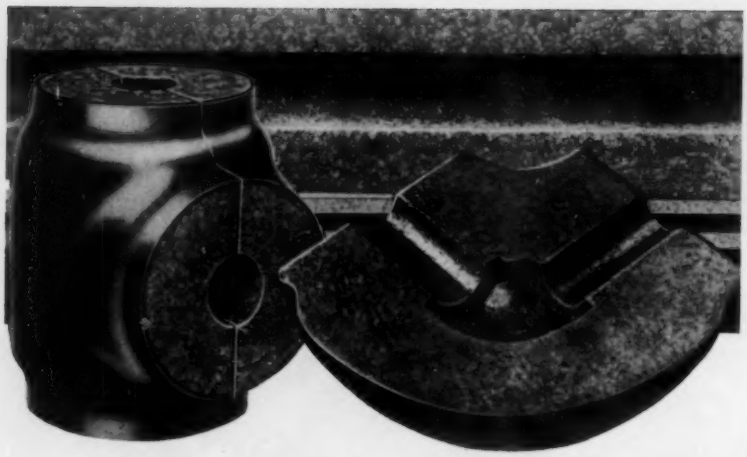
Sold by Leading Wholesalers—Information on Request


LITTLE GIANT UNIT HEATERS


GIANT UNIT HEATERS

SERIES C UNIT HEATERS

GAS FIRED UNIT HEATERS



UNITED CORK PIPE COVERING

Light Duty Thickness (Ice Water)	to 30° F
Medium Duty Thickness (Brine and Ammonia)	to 0° F
Heavy Duty Thickness (Heavy Brine)	to —25° F or lower

For all standard pipe sizes and fittings. Molded of compressed pure granulated cork, finished with moisture-proof mineral mastic.

LARGER STOCKS...FASTER DELIVERY...PERSONAL SERVICE

United Cork Companies have expanded their facilities to include the production of cork pipe covering. Increased quantities of most frequently used sizes are now available at key points coast to coast . . . in either distributor or branch warehouse stocks . . . thus insuring fast delivery of your installation requirements.

CORK... STILL UNSURPASSED AS A COLD LINE INSULATOR

- Extremely low thermal conductivity
- Saves at least 80% of refrigeration lost from bare piping
- Easily economically applied
- Permanent and durable, lowest long-term cost
- Does not support combustion
- Neat, sanitary, vermin-proof
- Has no capillarity

YOUR INQUIRY will bring you specifications, helpful installation data, descriptive material on United's cork pipe covering . . . and patented BB (block-baked) 100% Corkboard specially processed for low temperature work. No obligation.

UNITED BB CORKBOARD

SEE OUR CATALOG IN SWEET'S

UNITED CORK COMPANIES

1 CENTRAL AVE., KEARNY, NEW JERSEY

Manufacturers of cork insulation for almost a half century

Engineering offices, or approved distributors, in key cities — coast to coast.

RECENT TRADE LITERATURE...

▸ *AIR CONDITIONING*—Booklet #RP-588 is reprint of talk on air conditioning systems for multistory buildings given by M.M. Lawler of Worthington Corp. at an ASRE meeting. Text reviews types of air circulation systems, their methods of operation, advantages and disadvantages. Worthington Corp., Harrison, N.J.

▸ *AUTOMATION*—Control by instruments in petroleum, chemical industries is subject of current issue of company's publication, *Kelloggram*. Diagrams illustrate basic functions of instruments used in automatic control. Sections discuss radio isotopes in level measuring devices, data reduction systems, electronic instrumentation, stream analyzers, high pressure instruments. M.W. Kellogg Co., 225 Broadway, New York 7.

▸ *BLOWERS*—New 8 page booklet, *Blowers—and what makes them work better*, covers installation procedures designed to insure better blower service in heating, air conditioning equipment. Brundage Co., North Park St., Kalamazoo, Mich.

▸ *BOILERS*—Bulletin A-104 contains size, rating information for gas, oil, gas/oil fired "Steamboilerplants" ranging 12 to 60 hp, 15 to 200 psi, according to Underwriters' Laboratories listing. Eclipse Fuel Engineering Co., 1002 Buchanan St., Rockford, Ill.

▸ *BUILT-IN CONDITIONER*—New brochure describes features, specifications of built-in wall air conditioner. Unit designed for apartment buildings, hotels, motels, office buildings as integral part of building. Amic Mfg. Corp., 21-25 44th Ave., Long Island City 1, N.Y.

▸ *BURNER PARTS*—New 240 page catalog covers parts for light and

NO SINGLE WELDER WILL DO IT ALL!

THERE'S EXACTLY
THE RIGHT **miller** WELDER
TO MEET EVERY WELDING REQUIREMENT

MILLER SR RECTIFIER TYPE DC ARC WELDERS

Available in 200, 300, 400 and 600 amperes, it is a superior direct current welder using Miller Unitron transformer control and selenium rectifiers for conversion from 3 phase AC line current. Miller SR Welders feature widest possible current range, extreme arc flexibility, maximum electrode deposition rate and highest electrical efficiency.

THE *New* MILLER SRH RECTIFIER TYPE DC ARC WELDER

A new concept in welder design for all DC metalic arc welding. Available in 200, 300 and 400 amperes. It is ruggedly constructed, compact, and is designed to lend itself to stacking for parallel operation or to conserve floor space. It has single range control and is weatherproof.

MILLER ARC WELDERS FOR TUNGSTEN ARC WELDING PROCESS

These Miller Welders feature the patented Miller UNITRAN control circuit which combines the transformer with its own integral flux diverter. This, in conjunction with adequate open circuit voltage, high frequency, balancing resistor and optional controls insures superior uniformity and flexibility throughout the entire welding range. Available in nine models.

THE *New* MILLER MULTI ARC COMBINATION AC-DC WELDER

Available in 14 models, this new Miller Welder provides both AC and DC welding power for applications where both are required. It operates from a single phase power line and is available with high frequency and controls designed especially for inert gas arc and spot welding.

MILLER 100 SERIES HEAVY DUTY INDUSTRIAL TYPE AC WELDERS

Designed for heavy production welding and automatic welding applications. Available in eight models. The 100 Series Welders permit faster welding—as much as 35% faster. Movable coil design and 80 volts O.C.V. produces uniform and better welding characteristics throughout the entire range of the welder.

Write today for complete information on these Miller Welders.

ARC - SPOT miller GENERATORS WELDERS

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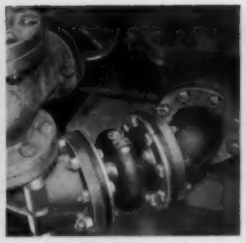
ELECTRIC MANUFACTURING CO., INC.
P.O. Box 798 Appleton, Wisconsin

"... if it's MILLER you know it's the finest..."

Garlock rubber expansion joint on vacuum line between turbine and condenser



Expansion joint operating on suction side of centrifugal pump handling condensate from condenser

Expansion joint operating on condensate pump discharge line

STOP NOISE,

VIBRATION, and

FLANGE BREAKAGE

WITH

GARLOCK EXPANSION JOINTS

GARLOCK rubber expansion joints absorb vibration and compensate for linear expansion and contraction of pipe lines. They stand up under repeated flexing—do not crack or fracture.

These flexible joints are used to prevent transmission of sound and to absorb vibration in air conditioning and water lines in commercial, institutional, and industrial buildings. Wear and tear on pipe flanges is reduced to a minimum.

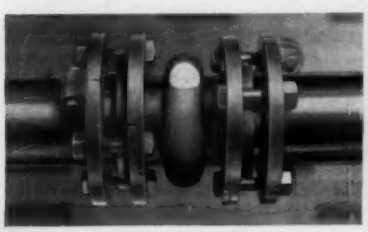
GARLOCK **Rubber Expansion Joints** are made for all pipe sizes ¾" to 72". **All "Teflon" Joints** or **Rubber Joints with Teflon liner** are made for chemical service; **Neoprene Joints** for oil service.

For complete information, write today for Folder AD-137.

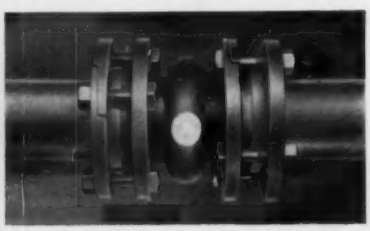
THE GARLOCK PACKING COMPANY, PALMYRA, N. Y.

Sales Offices and Warehouses: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, Los Angeles, New Orleans, New York City, Palmyra (N.Y.), Philadelphia, Pittsburgh, Portland (Ore.), Salt Lake City, San Francisco, St. Louis, Seattle, Spokane, Tulsa

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.



Garlock expansion joint applied to pipe made by Haveg Corp.



Garlock expansion joint applied to pipe made by The Duriron Co., Inc.

RECENT TRADE LITERATURE

Continued

heavy oil burners, gas burners, stokers. Nearly 2000 pictures illustrate fuel units, transformers, motors, controls, low water cutoffs, feed circulators, etc. in company's line. Sid Harvey, Inc., Valley Stream, N.Y.

▸ *CENTRIFUGAL PUMP*—Bulletin describes stainless steel centrifugal pump designed for handling severe corrosives. Information includes mechanical features, performance data, component materials of construction, operating advantages. Eco Engineering Co., 12 New York Ave., Newark 1.

▸ *CLASSROOM UNIT VENTILATOR*—New 4 page bulletin details features of unit ventilator designed for school classroom installation. Cutaway drawing illustrates method of operation. Bulletin also discusses combination heating-cooling units for hotels, motels, hospitals, office buildings. Rittling Corp., Rittling Bldg., Buffalo 5.

▸ *COAL TAR TAPE*—How to get increased coverage at economy in safeguarding pipe, joints, fittings, couplings described in new 4 page brochure. Covers "Tapecoat-X" coal tar tape with extra thickness designed for double wrap protection with single wrap application. Tapecoat Co., 1523 Lyons St., Evanston, Ill.

▸ *COMBUSTION CONTROL*—Bulletin E-104 covers automatic combustion control for oil, gas, coal fired boilers. Illustrates, describes instruments in line. Lists outstanding features. Reliance Instrument Mfg. Corp., 190 Glen Cove Ave., Glen Cove, L.I., N.Y.

▸ *CONDENSATION RETURN UNITS*—Bulletin 113-HR describes "Apco-Matic" condensation return units for heating systems with EDR ratings 800 to 10,000, pressures to 80 psi. Details simplex, duplex models. Explains advantages of vertical turbine type pump design. Selec-

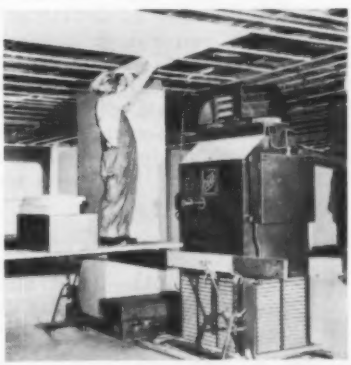
Heaters put Chicago's new skyscraper ahead of schedule!

Maintaining tight building schedules on the new 41-story Prudential Mid-America Building during rugged Chicago wintertime weather called for more than conventional construction heating devices.

George A. Fuller Company, general contractors, selected sixteen Dravo "Counterflo" Heaters and used two on each floor. Since "Counterflo" Heaters are a complete self-contained heating package, it was a simple matter to place the units in service by merely utilizing a portable fuel tank and "plugging in" to a 220-volt outlet. With this type of operation it was easy to rotate heaters from floor to floor as building activity progressed.

Despite temperatures as low as 15 degrees below, and icy winds up to 50 miles per hour, each Dravo Heater blanketed an area of more than 40,000 square feet with warm air. Workmen handled their job in comfort, unimpeded by the need for heavy clothing. Results? Minimum time off for colds and cold weather ailments, ahead of schedule on construction, earlier-than-planned occupancy. These heaters provided further benefits in that drying of plaster, cement and paint was also accelerated.

This rather unique application points out another of the many benefits that make Dravo Heaters your best heating investment today. Now, in addition to quality construction and top operating efficiency, Dravo "Counterflo" Heaters carry a fully bonded guarantee on all vital parts for 10 years! Such features make Dravo Heaters today's best *and most economical* heating buy! You can get complete details today by using the coupon below.



Dravo Corporation, Department A-1410
Fifth & Liberty Avenues
Pittsburgh 22, Pa.

I am interested in Dravo Heaters for _____ btu per hour

☐ Please send literature

☐ Please have a representative call

DRAVO
CORPORATION
Pittsburgh 22, Pennsylvania
Representatives in all principal cities

Name _____

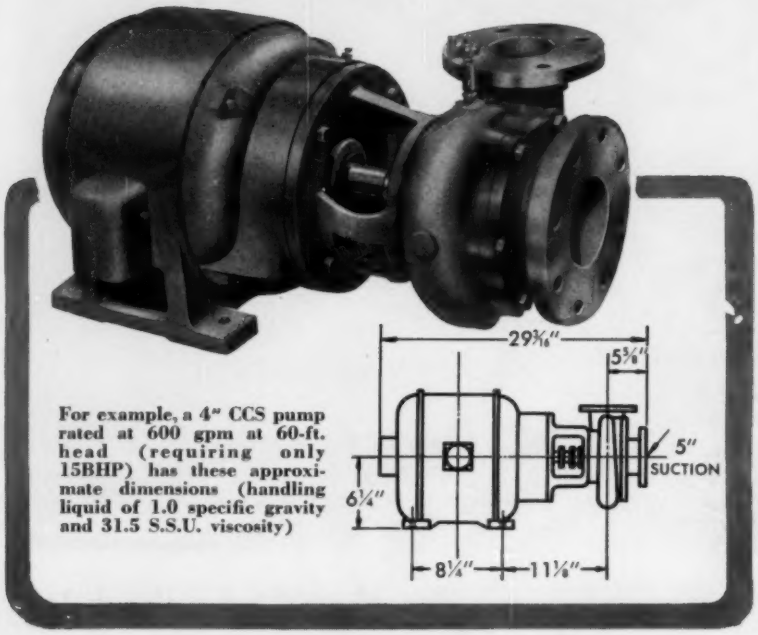
Company _____

Address _____

City _____ Zone _____ State _____

MORE G.P.M. per CU. FT. of space!

"Buffalo" Close-Coupled Pumps



For example, a 4" CCS pump rated at 600 gpm at 60-ft. head (requiring only 15BHP) has these approximate dimensions (handling liquid of 1.0 specific gravity and 31.5 S.S.U. viscosity)

Little more than two feet in overall length and taking up less than two cubic feet of space, this pump illustrates the space you can save with this line of husky, efficient "Buffalo" Close-Coupled Pumps. Sizes range from 1" to 6" discharges — capacities up to 880 gpm, all of proportionately small dimensions. Besides the savings in space, you enjoy permanent shaft alignment, plus the high efficiency performance and long life for which "Buffalo" Pumps have long been noted. Request Bulletin 975 for full details.

This is just one of many types of "Buffalo" Pumps ready to give you top performance. Others include Paper Stock, Chemical, Boiler Feed, Double Suction, Sump, etc. — all built to the rigid standards of our time-proven "Q" Factor*.

"Buffalo" PUMPS

*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

BUFFALO PUMPS, INC.
171 MORTIMER STREET BUFFALO, N. Y.
Subsidiary of Buffalo Forge Company
Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

RECENT TRADE LITERATURE

Continued

tion tables cover dimensions, capacities, weights, specifications. Aurora Pump Div., New York Air Brake Co., Aurora, Ill.

▸ *CONTROL VALVE*—Valve which converts from pressure reducing, regulation to back pressure control by switch of control lines described in new 4 page bulletin. Pilot operated unit recommended by company for air, water, light oils, various gases, refrigerants, other noncorrosives. A.W. Cash Co., P.O. Box 551, Decatur, Ill.

▸ *CONTROL VALVES*—Specification sheet covers new line of diaphragm control valves. Data includes actuator and body specifications, flow characteristics, dimensions for double and single seated and three-way types. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44.

▸ *DOOR HEATERS*—New bulletin has selection chart for choosing proper heater size for given door size, given set of temperature conditions. Dimensions, capacities, methods of control included in text. L.J. Wing Mfg. Co., Linden, N.J.

▸ *DUCT*—New 4 page folder, *Transite Warm Air Duct*, covers installation, performance advantages of asbestos-cement "Transite" as duct for warm air perimeter heating, air conditioning systems. Gives information on sizes, lengths, fittings. Johns-Manville, 22 E. 40th St., New York 16.

▸ *ELECTRIC WELD STEEL TUBING*—Table listing internal hydrostatic pressures for testing welded tubing is feature of new 4 page bulletin. Data given on sizes ½ to 5 in. OD. Nikoh Tube Co., 5000 S. Whipple St., Chicago 32.

▸ *EVAPORATIVE CONDENSER*—New 6 page folder covers "Aqua-Fog" evaporative condensing unit. Includes tables for suction tempera-

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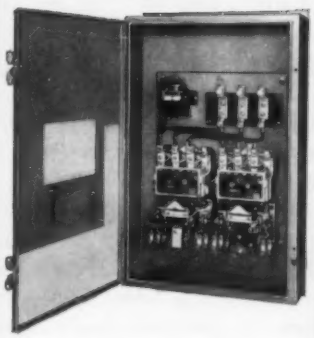
do the best job for AIR CONDITIONING



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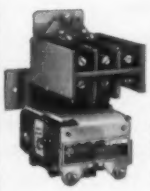

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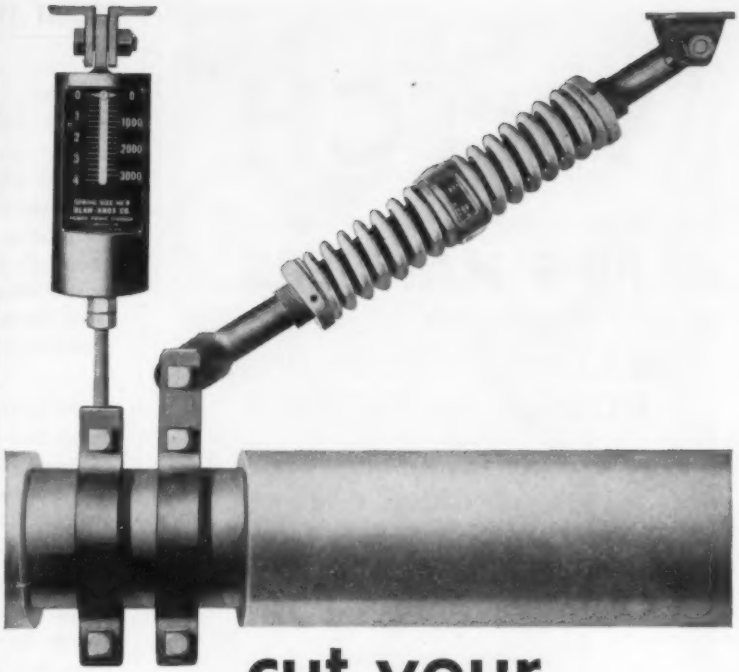

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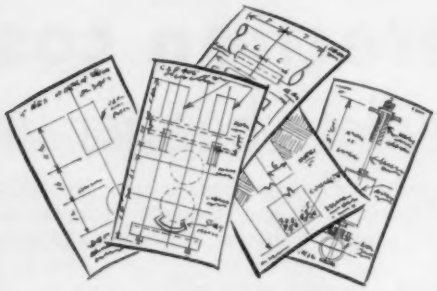

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RECENT TRADE LITERATURE

Continued

ture correction factors, condenser selection. Cobell Industries, Inc., P.O. Box 1157, Ft. Worth 1.

▸ *FANS*—New 4 page bulletin No. 7214 describes "Ventura" fans for commercial, industrial ventilation. Discusses features of v belt driven fans, their application. Performance data lists electrical power requirements, delivery ratings at different static pressures, fan speed, horsepower, nominal rotor diameter. American Blower Corp., Detroit 32.

▸ *FLUE GAS ANALYZER*—Method of operation, design and construction features of portable flue gas analyzers covered in new 4 page bulletin. Discusses five models, accessories available. Has illustrated flow diagram. Thermco Laboratories, Michigan City, Ind.

▸ *GAS POWERED CONDITIONING*—Company's "Cobaire" natural or LP gas powered air conditioning system discussed in new 6 page folder. Lists applications, tells principle of operation, details features. Cobell Industries, Inc., P.O. Box 1157, Ft. Worth 1.

▸ *GATE VALVES*—Circular describes "Causul" metal gate valves designed for corrosion service. Includes descriptive data, dimension and application tables. Valves available in bolted bonnet or "King-Clip" patterns with screwed or flanged ends in sizes ½ to 8 in. Lunkenheimer Co., Box 360, Cincinnati 14.

▸ *GENERATORS*—Forced recirculation generators for high temperature water heat distribution systems discussed in 10 page bulletin No. 700. Describes specific features, cites advantages of high temperature water systems. International Boiler Works Co., Palm St., East Stroudsburg, Pa.

▸ *HEATING CONTROLS*—New automatic control devices, systems described in company's 1955-56 heating division catalog. Electric, pneumatic, electronic, self powered temperature control systems; oil, gas, stoker, electric heating control devices; automatic air conditioning, humidity, water heater, refrigeration regulators; other devices for commercial, industrial, farm, home applications covered in 99 page booklet. Minneapolis-Honeywell Regulator Co., 2641 Fourth Ave., S., Minneapolis 8.

▸ *HOOKUP DIAGRAMS*—Diagrams show hookups for indirect (tankless) water heaters for hot water usage. Designed to aid contractor in installations where storage tanks not required. Shows how delivery of continuous tankless volume hot water is possible 24 hours a day. Portmar Boiler Co., 193 Seventh St., Brooklyn.

RECENT TRADE LITERATURE *Continued*

▸ *ICE SKATING RINKS*—New 32 page report, *Ice Skating Rinks—Their Construction and Maintenance*, prepared for engineers, architects, arena superintendents, contains foreword, conclusion, and major sections listed under subject headings: corrosion, corrosion control, service data, installations, minimizing maintenance, brine tables. Compares, contrasts wrought iron and steel piping. Has illustrations of rinks, rink piping. A. M. Byers Co., Clark Bldg., Pittsburgh 22.

▸ *LIQUID DEPTH GAGES*—Bulletin 6004 covers series "1400" industrial liquid depth gages designed for accurate measurement in storage tanks in petroleum, chemical, paint, food, other process industries. Covers four indicators in series, gage accessories. Liquidepth Indicators, Inc., 43-22 10th St., Long Island City 1, N.Y.

▸ *METAL HOSE*—Use, application data on flexible metal hose products offered in reference catalog U-333. Products made in bronze, carbon steel, monel, nickel, stainless steel. Designed to compensate for varied pressure conditions, elevated temperature, motion, vibration for range of conveyance problems. Universal Metal Hose Co., 2133 S. Kedzie Ave., Chicago 23.

▸ *OIL BURNER ELECTRODES*—New catalog E-55 on ignition electrode assemblies for oil burners contains 20 pages of data, drawings. Wm. Steinen Mfg. Co., 43 Bruen St., Newark 5.

▸ *PACKINGS*—New 48 page catalog contains descriptions, recommended uses, specifications, illustrations for each of company's line of rod and sheet packings. Covers gasket cutters, asbestos gaskets and tape, valve discs, pump valves. Allpax Co., Inc., Mamaroneck, N.Y.

▸ *PORTABLE HEATER*—Lightweight portable heater is subject of new 4 page folder. Cutaway drawing shows vital parts of "Master B-100." Operational photographs illustrate how mechanical (heating, piping, air conditioning) contractor can use. Master Vibrator Co., 363 Stanley Ave., Dayton, Ohio.

▸ *PRESSURE GENERATORS*—Bulletin No. 755 describes "aiROYmetric" pressure generators designed to produce hydrostatic pressures to 500 times greater than normal plant air supplies. Includes overall capacity pressure ranges, theory of operation, application details. Milton Roy Co., 1300 E. Mermaid Ln., Philadelphia 18.

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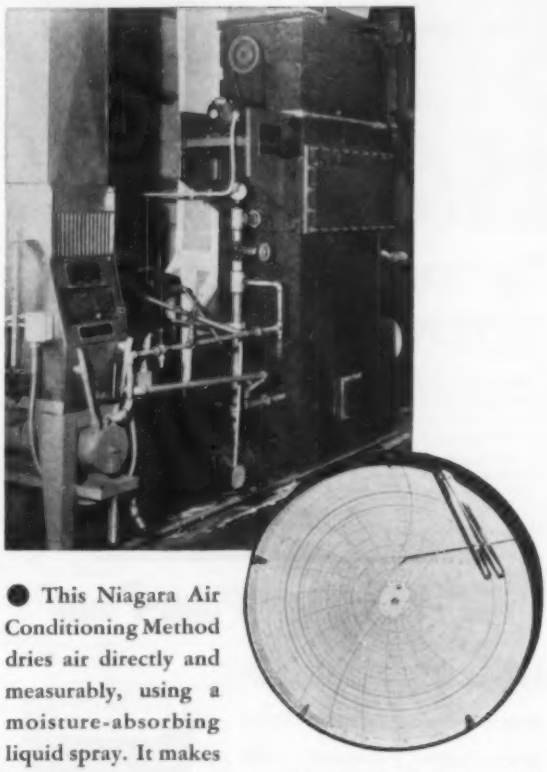
To Improve Your Product or Protect Your Materials or for Processes or Tests



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Niagara Air Conditioning provides you with any temperature and relative humidity you need. Using "Hygrol" absorbent, it is not expensive to operate, saving the refrigeration commonly used to condense moisture and making re-heat unnecessary in most cases. It gives large capacity with compact, easily-maintained equipment. Ask for Descriptive Bulletins #112 and #121. Address Dept. — HP

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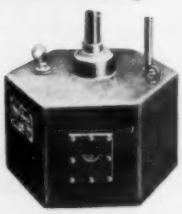
acids . . alkalis . . abrasive liquids . . brine . . mud . . molasses . . oils . . paints . . sludges . . slurries . . tars



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RECENT TRADE LITERATURE *Continued*

▸ *PROXIMITY METER*—Electronic instrument designed to measure without touching specimen described in new 28 page booklet. Instrument is said to detect temperature changes of 1/1000th C deg, variations to 1/millionth in. Fielden Instrument Div., Robertshaw-Fulton Controls Co., 2920 N. Fourth St., Philadelphia.

▸ *PYROMETER SERVICING*—Bulletin F 7259 gives service tips for pyrometer users. Covered are what to do when instrument reads erratically, instrument temperature curve off, instrument reading too high or too low, instrument controls erratically. Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill.

▸ *RECORDERS*—Bulletin describes 6 in. strip chart recorders for pressure, liquid level, temperature, flow, mechanical motion. Contains installation drawings showing applications to different variables. Illustrates various models, their features. Bristol Co., Waterbury 20, Conn.

▸ *REGULATOR CONTROLS*—New 36 page bulletin No. 1094 details high, low pressure balanced valve regulators. Covers special arrangements in which each may be used. Discusses specific regulator problems, gives their solutions. Meter and Valve Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8.

▸ *RELIEF VALVES*—Two new temperature-pressure relief valves, two pressure relief valves covered in company's catalog supplement. Patrol Valve Co., 2310 Superior Ave., Cleveland 14.

▸ *RESIN—"Nafil"* resin for polyurethane foam for structural reinforcement, acoustical treatment, cushioning, insulation, shock absorbing, sound deadening covered in 4 page bulletin. Lists technical data, suggested uses. Chase Chemical Corp., 3572 Smallman St., Pittsburgh 1.

▸ *ROLLING BEARINGS*—New 52 page bulletin contains technical information, list prices on "SC" ball and "Dodge-Timken" roller bearings. Tabular data covers engineering drawings, dimensions, shaft sizes, weights, radial load ratings. Illustrations include cutaway views showing inner construction. Dodge Mfg. Co., Mishawaka, Ind.

▸ *SHEET, STRIP STEEL*—New 8 page bulletin 20-1 lists over 20 different kinds of flat rolled steel in coils, stock sizes, cut-to-order blanks. Suggestions given for stock selection, buying to give economy with best end results. Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80.

RECENT TRADE LITERATURE

Continued

▸ *SOLENOID VALVE*—Description of new four-way dual and single solenoid valve contained in bulletin V5003. Flow diagrams shown. Dimensions, list prices given. Automatic Switch Co., 391 Lakeside Ave., Orange, N. J.

▸ *SPRAY NOZZLES*—New 20 page booklet gives description, application data, capacity charts, dimension tables, etc. for company's line of spray nozzles. Also, article, *Recooling Water in Spray Ponds*, available. Yarnall-Waring Co., Mermaid Ln., Philadelphia.

▸ *STEEL PIPE—Promoting Steel Pipe* is 12 page brochure covering activities of Committee on Steel Pipe Research. Covers research, plumbing codes, media advertising, literature, exhibits, publicity, collaterals phases of program. Committee on Steel Pipe Research, American Iron and Steel Institute, 350 Fifth Ave., New York 1.

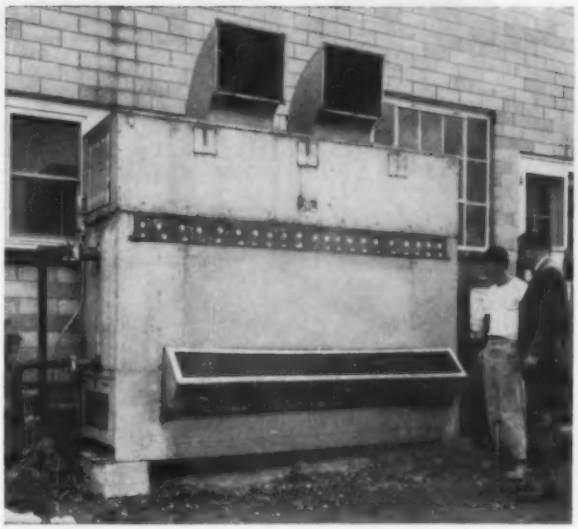
▸ *THERMOCOUPLE CONNECTORS*—Specification sheet 56 describes Army Navy thermocouple connectors designed for quick, easy detachable connection to one or more circuits. Consist of mating plug, receptacle assemblies. Are engineered to prevent incorrect assemblies. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44.

▸ *THERMOCOUPLES*—Specification sheet 57 describes new two wire thermocouples with 1/8, 3/16 in. diameters. Are for use where sensitivity, accuracy important, space limited. In lengths 6 to 72 in. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44.

▸ *TWO-STAGE PUMPS*—Two-stage pumps for boiler feed, other high pressure applications described in new bulletin 52B6105C. Units available in close coupled and frame type construction in capacities to 300 gpm at heads 300 to 550 ft at temperatures to 250 F. Bulletin includes dimension tables, performance charts for both types. Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee.

▸ *UNIT CONDITIONERS*—"Diaflo" unit conditioners for summer cooling, winter heating discussed in bulletin No. 8227. Operation, construction, design features described and illustrated. Bulletin shows typical installations in free standing, full recessed, floor and ceiling mounting arrangements. American Blower Corp., Detroit 32.

▸ *V BELT DRIVES*—"Tex-Book" 20P40 is 74 page booklet with tables for selection of constant speed "Texrope" v belt drives. Lists design features, basic



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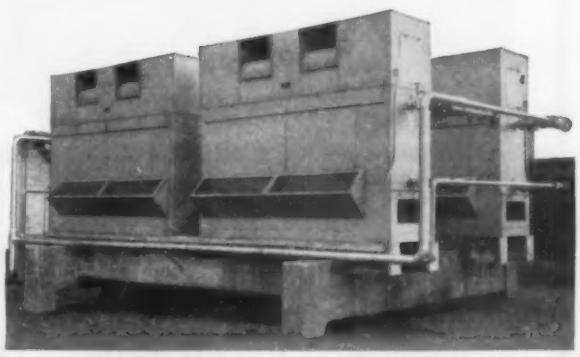
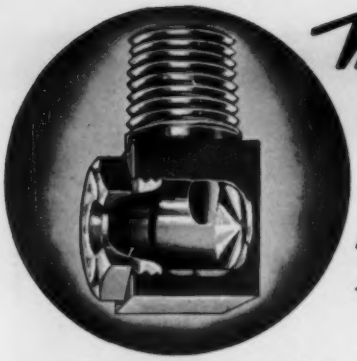


These condensers are among many in Buffalo equipped with Frick-Mollenberg super-saving control.



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RECENT TRADE LITERATURE

Continued

drive principles, technical data on sheaves. Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee.

▸ *WATER SUPPLY PUMPS*—Vertical turbine pumps for industrial, municipal primary water supply described in 8 page bulletin 100. Publication contains sectional illustrations, detailed drawings. Condensed selection table gives head, capacity ratings of "Verti-Line" pumps. Layne & Bowler Pump Co., 2943 Vail Ave., Los Angeles 22.

▸ *WELDING*—Company's "Three-Phase" principle of operation for resistance welding discussed in new 4 page bulletin 332-10. Principle offers lower costs, greater weld consistency, longer electrode tip life, says company. Sciaky Bros., Inc., 4915 W. 67th St., Chicago.

▸ *WELDING ALLOYS, FLUXES*—New 32 page pocket booklet is condensed reference for choosing specialty alloys, fluxes. Superseding earlier issue, covers data on 15 alloys not previously catalogued. Also details company's "Jet-Flux" system. All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N.Y. ‡

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A completely automatic, foolproof unit designed to remove hot or cold condensate fluids from the receiver tank and pump it to an outside drain. Simple to install with air conditioning equipment, it gives quiet and reliable performance.

Eastern Model 3, Type 100:
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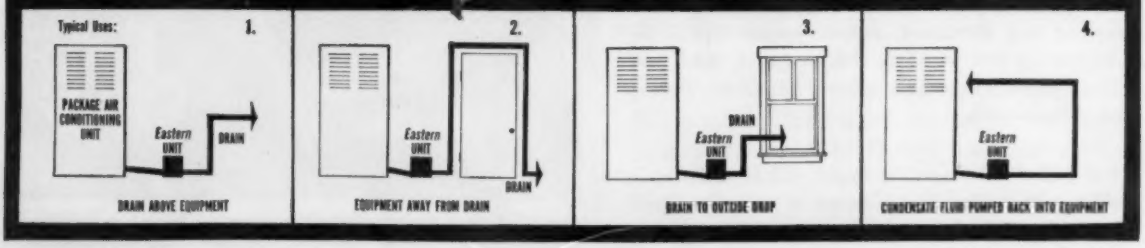

WHO'S WHAT...

(New personnel, promotions)

▸ *LOUIS ALLIS CO.*—E. P. Allis, chairman of the board; John W. Allis, president.

▸ *CHARLES SIMKIN & SONS*—Joseph Dobransky, field superintendent, Alexander Sage, vice president in charge of engineering; Robert Solmor, chief piping engineer; Edward Greenwald, chief air conditioning engineer.

▸ *WESTINGHOUSE ELECTRIC CORP.*—Gwilym A. Price, president, chairman of the board and chief executive officer; Mark W. Cresap, Jr., executive vice president and deputy chief executive officer; Latham E. Osborne, vice chairman of the board; John K. Hodnette, vice president, general manager and director; A. C. Monteith, vice president in charge of the company's apparatus products divisions; Dr. John A. Hutcheson, vice president in charge of engineering and research; Donald R. Meckstroth, manager of marketing service for the air conditioning division.

▸ *BRYANT DIV., CARRIER CORP.*—Philip C. Kosch, sales manager.

▸ *JOHNS-MANVILLE*—John A. O'Brien, director of realigned industrial products division, which will start operation January 1. Mr. O'Brien is a senior vice president at JM. The division will comprise an industrial products group with the following acting as general managers of each section: Don L. Hinmon, industrial insulations division; Francis J. Wakem, packings and friction materials division; Robert F. Orth, pipe division. Messrs. Hinmon and Orth are also named vice presidents of Johns-Manville Sales Corp.

▸ *TITUS MFG. CORP.*—Harold E. Straub, director of the company's new research laboratory, now under construction.

▸ *SEELYE STEVENSON VALUE & KNECHT*—Jack L. Staunton, an associate of the firm.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—R. S. Reynolds, Jr., chairman of the board; J. Louis Reynolds and John A. Robertshaw, Jr., directors. Mr. Reynolds, Jr. succeeds his father, R. S. Reynolds, Sr., who died July 29. Charles A. Maloney, Jr. has been appointed to the company's Fielden Instrument Div. to handle government and subcontract sales.

▸ *HAMMEL-DAHL CO.*—John R. Curran, vice president. He has been serving as director of engineering.

4 steps

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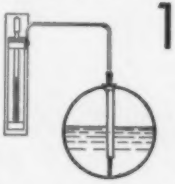
The PETROMETER Tank Gauge offers you the convenience of Remote Reading plus these four extra features:

SIMPLE, TROUBLE-FREE DESIGN • • • No complicated and troublesome pulleys, springs, or other mechanical or electrical gadgets—the Petrometer gauge operates on the principle of static pressure—a principle that is as unfailing as the law of gravity. Its operation is similar to that of the familiar U-tube. Simple, rugged and dependable.



1

CONSTANT ACCURACY • • • The large vertical scale on the Petrometer gives you constant, accurate readings. The red liquid column is clearly visible—moves up and down as contents vary, just like the liquid level in your tank.

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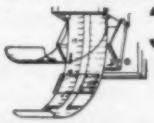
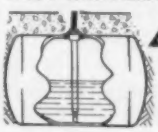


3

EASY INSTALLATION • • • Gauges can be installed on tanks above or below the ground and up to ¼ mile away. The tank assembly for the gauge can be installed even when the tank contains liquid. It can also be fitted in the tank separately to complete the tank work and the gauge connected any time later. Just tighten one simple connection and installation is complete.



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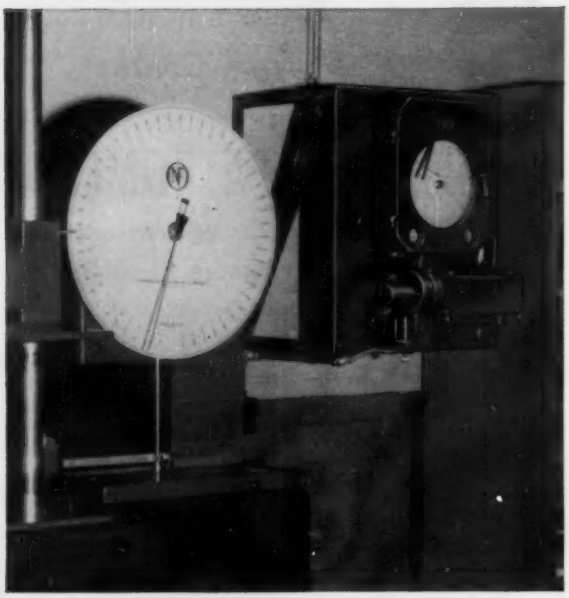
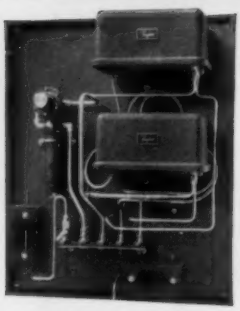
±1% HUMIDITY CONTROL

For Heating, Piping and Air Conditioning





Now your laboratory or test room can have humidity control on the basis of *percentage of relative humidity*—instead of on the individual performance of wet and dry bulbs. Taylor's Wet-and-Dry Bulb Temperature Controller (above) can maintain ±1% relative humidity. That means you have standard conditions for physical testing of products. This amazingly close humidity control is achieved by the Taylor FULSCOPE* Recording Wet-and-Dry Bulb Controller using as measuring systems two Taylor TRANSAIRE* Temperature Transmitters with SPEED-ACT* compensation for lags in heat transfer (see picture at left).

If your production requires close humidity control, it will pay you to look into Taylor Automatic Control with TRANSAIRE Transmitters. Ask your Taylor Field Engineer or write for **Bulletin 98140.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

*Trade-Mark

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

WHO'S WHAT *Continued*

▸ *GARLOCK PACKING CO.*—George L. Abbott, chairman of the board and chief executive officer; Robert M. Waples, president, succeeding Mr. Abbott. Mr. Waples has been executive vice president since late 1952.

▸ *ALLIS-CHALMERS MFG. CO.*—Hugh L. Ross and Charles L. Babb, assistant manager and chief engineer, respectively, for the centrifugal pump department.

▸ *AMERICAN AIR FILTER CO., INC.*—Dwight M. McMakin, an associate of the executive committee of the Oil and Gas Power Div. of the American Society of Mechanical Engineers. Mr. McMakin is assistant manager of AAF's engine and compressor department.

▸ *NATIONAL-U.S. RADIATOR CORP.*—Dr. Walter L. Ross, associated with the engineering and research department as manager of the development laboratories; Burl C. Brown, manager of air conditioning research; John W. Hall, director of advertising and sales promotion; C. J. Philage, advertising manager; Homer L. Andrews, director of market research.

▸ *OLIN MATHIESON CHEMICAL CORP.*—David T. Marvel, vice president in charge of sales for the metals division; E. W. Sherman, sales manager for all brass products; H. F. Devens, sales manager for all roll bond products.

▸ *OWENS-CORNING FIBERGLAS CORP.*—Changes in the industrial insulation products group of the industrial construction materials division: William H. Wiseman, transferred from the Philadelphia branch to become manager of power and process industrial insulation sales; W. J. Lemasters, manager of commercial and light industrial insulation sales; Earl W. Hymes, administrative assistant to Hugh T. Williams, sales manager.

▸ *BUSH MFG. CO.*—Alan S. Decker, vice president in charge of manufacturing and general engineering. He was general manager of Heat-X, Inc., a Bush subsidiary.

▸ *KINNEY MFG. DIV., NEW YORK AIR BRAKE CO.*—W. H. Crowley, chief engineer in charge of production, development, research, and vacuum systems and equipment; J. Raymond Marshall, equipment sales engineer.

▸ *SMOOTH-ON MFG. CO.*—George T. Morse, vice president and director of sales.

"I shot an arrow into the air,
It fell to earth, I know not where."

The Arrow and the Song—Longfellow, 1845

Longfellow a space buyer?

Longfellow's lament could well have been applied to advertising back in 1845. Yes, even up to 1914 when a group of advertisers, agencies and publishers, alarmed by the waste and guesswork in their business, brought order out of advertising chaos by organizing the Audit Bureau of Circulations. These pioneers in circulation auditing established a definition for paid circulation, rules and standards for measuring circulation, methods for auditing and reporting the FACTS.

For value-minded advertisers the era of blind space buying ended in 1914. ☆ ☆ Today's experienced space buyers use the audited information in A.B.C. reports to aid them in applying media to markets and get full value for advertising dollars. Here are some of the FACTS in A.B.C. reports that provide a sound basis for advertising investments: • How much paid circulation • How much unpaid distribution • Occupational or business breakdown of subscribers • Where they are located • How much subscribers pay • Whether or not premiums are used • How many subscribers in arrears • What percentage of subscribers renew. ☆ ☆ Sales messages go direct to their targets, there's no shooting "into the air" when space buyers base their decisions on A.B.C. FACTS. This publication is a member of the Audit Bureau of Circulations because we want our advertisers to know what they get for their money when they use space in these pages. Ask for a copy of our A.B.C. report and then study it.

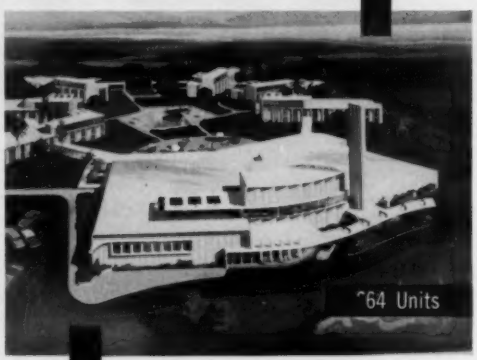
SEND THE RIGHT MESSAGE TO THE RIGHT PEOPLE

Paid subscriptions and renewals, as defined by A.B.C. standards, indicate an audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.

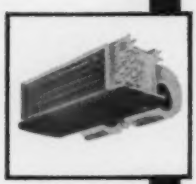
A.B.C. REPORTS—FACTS AS A BASIC MEASURE OF ADVERTISING VALUE

New! Really Compact!

drayer-hanson
SPOTAIRE-LRC
Air Conditioning



. . . airway set for new Lady Luck Hotel, Las Vegas
* rendering courtesy Architect Homer Rissman



LRC Basic Unit

LRC Concealed Cabinet

No individual-room equipment for complete air conditioning of multi-room structures allows such design freedom for the architect . . . achieves such "pin-drop" quietness of operation!

Eye-opening . . . new D-H Spotaire LRC's require just 11½" head-room from ceiling; provide your best answer for low-cost, individual room air conditioning. 3-speed controls. For cooling, heating, dehumidifying, filtering. Old or new construction.

There's also a full LRC story — installation — operation — no-maintenance — you should know about . . .

Request catalog L.P. 5.220

d-h SINCE 1910

drayer-hanson INCORPORATED

3301 Medford Street • Los Angeles 63, California
(Subsidiary of National - U.S. Radiator Corporation)

WHO'S WHAT

Continued

▸ *IRON FIREMAN MFG. CO.*—Richard T. Walker, manager of plant educational services.

▸ *MUELLER CLIMATROL DIV., WORTHINGTON CORP.*—N. E. Hill and Richard Signorelli, manager of heating engineering and manager of cooling engineering, respectively, in the division's engineering department.

▸ *JOSEPH T. RYERSON & SON, INC.*—Edward J. Richardson, manager of the tubular products and cold finished bar division.

▸ *COMBUSTION ENGINEERING, INC.*—Carmine J. Grossi, manager of export division; Frank J. Bader, assistant general sales manager in New York; Herman C. Reichard, district manager in San Francisco.

▸ *"KINETIC" CHEMICALS DIV., E. I. DU PONT DE NEMOURS & CO., INC.*—Ralph A. Crane, market research manager; Joseph C. Hoopes, manager of refrigerant field distribution sales.

▸ *ACME INDUSTRIES, INC.*—William R. Eichelberger, vice president and director of sales; Walter A. Sharritts, vice president in charge of manufacturing.

▸ *BABCOCK & WILCOX CO.*—Carl Claus, director of staff; J. E. Brinkerhoff, manager of the refractories division, replacing A. M. Kohler, retired.

▸ *AIRTEMP DIV., CHRYSLER CORP.*—S. Anderson, Jr., sales manager in charge of industrial and commercial air conditioning. Mr. Anderson was assistant sales manager in charge of Airtemp's southern sales division.

▸ *A. O. SMITH CORP.*—James F. Donnelly, special assistant to F. S. Cornell, vice president and general manager. For the past three years Mr. Donnelly has been a vice president of Servel, Inc.

▸ *TOLEDO PIPE THREADING MACHINE CO.*—C. E. Hartsing, manager of field sales.

▸ *McQUAY, INC.*—Philip S. Morris, resigned as executive vice president and director. Appointments are: Frank F. Altman, manager of heating and air conditioning coil department; Alvin R. Flynn, manager of air conditioning unit department; Richard E. Sorenson, manager of unit heater department.

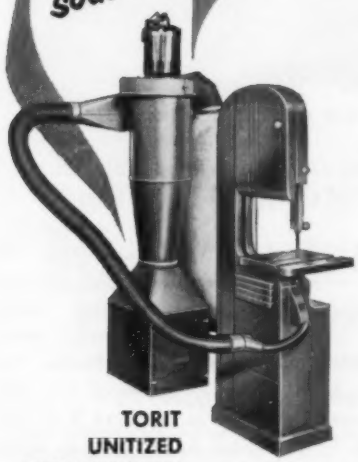
▸ *ELECTRIC STORAGE BATTERY CO.*—Ervin Seltzer, manager of industrial engineering of the Exide Industrial Div.

TORIT

UNITIZED

DUST CONTROL

eliminates dust at its source!



TORIT UNITIZED

DUST CONTROL means each machine has its own custom-tailored dust collector designed to work specifically for *that* machine. There is no guess work, or average suction. Furthermore, dust control is provided only when that machine is running . . . there is no waste of power such as you have with centralized control when only a few machines are operating. This means better dust control at lesser operating cost and less initial installation cost. Get the facts now on how Torit will work better to . . . "CLEAR THE AIR".

See our catalog in Sweet's Machine Tool File, or write:

TORIT

MANUFACTURING CO.

283 WALNUT STREET

ST. PAUL 2, MINNESOTA

You Can Rely on

GOODALL

EXPANSION JOINTS

For Ease of Installation and Long, Efficient Service

The problems of vibration, undesirable sound resulting from it, or expansion and contraction, are met with reliable efficiency and economy in GOODALL Rubber EXPANSION JOINTS . . . products of long experience and uncompromising craftsmanship.

EASIER TO INSTALL . . . on new construction or as replacements for other types. Light in weight . . . short face-to-face dimensions . . . retaining rings or flanges quickly aligned and bolted. "Flang-Lok" Joints are especially easy to install, and provide a non-metallic seal.

RESPONSIVE TO MINIMUM PRESSURE . . . Only slightest pressure is required to create movement in the rubber joint, in any direction. Result — stress on metal pipe or other member is reduced to absolute minimum.

HIGHER WORKING PRESSURES . . . Goodall Rubber Expansion Joints operate efficiently at working pressures to 125 lbs. P.S.I., depending on size.

LONGER SERVICE LIFE . . . No embrittlement . . . continuous movement (Flexing) actually keeps the rubber joint "alive." No corrosion. No electrolysis. Highest resistance to abrasion.

WIDE SELECTION . . . Three Types — "Flang-Lok", Right Angle and Sleeve. Five styles — Single Arch, Multiple Arch, Tapered, Offset and Rectangular. All sizes — From 3/8" I.D. to 96" I.D. For pressure, vacuum or both.

Send for Illustrated Booklet . . . or Contact Our Nearest Branch for Specific Information

GOODALL RUBBER COMPANY

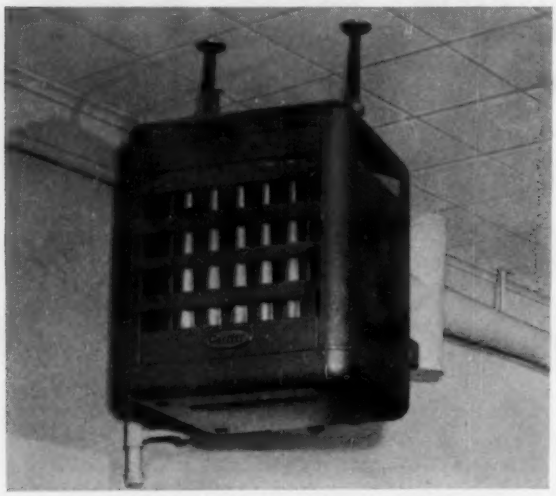
GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

Branches: Philadelphia • New York • Boston • Pittsburgh • Indianapolis • Chicago • Detroit • St. Paul
Los Angeles • San Francisco • Seattle • Spokane • Portland • Salt Lake City • Denver
Houston • Goodall Rubber Company of Canada, Ltd., Toronto • Distributors in Other Principal Cities

Est. 1870

Carrier knows heating

Over fifty years of leadership in air conditioning have given Carrier unmatched experience in the control of temperature —heating as well as cooling. Yes, Carrier knows heating by experience—and all this engineering skill and leadership contributes to the superiority of Carrier Unit Heaters.



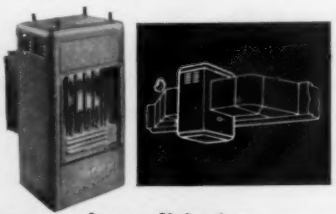
CARRIER GAS-FIRED UNIT HEATERS

begin with the outstanding midget-size Model 46T50/70, shown above. Only 23 inches high and relatively light in weight, this propeller-fan type unit heater packs a hefty 50,000 to 70,000 Btu/hr. input (according to fan-motor size). It is designed for use when both space and heating requirements are important.

And for extra-long life, only the Carrier line embodies the major advantage of 16-gauge ALUMINIZED STEEL heat exchanger. It lasts far longer than one of ordinary furnace steel of heavier gauge. The dozen or more other Carrier features are equally impressive. Six additional sizes.

Get the complete story about the full Carrier gas-fired line . . . propeller-fan and duct models ranging up to 230,000 Btu capacity. WRITE or USE COUPON for a copy of the 12-page folder on Carrier Gas-fired Unit Heaters.

Duct-type unit heaters embody all the major structural and control features of the fan-propelled model—minus fan. By-pass duct application shown here permits year-round air conditioning through the Carrier Weathermaker System. Available in seven sizes.



Carrier

air conditioning
refrigeration
industrial heating

CARRIER CORPORATION, 305 S. Geddes St., Syracuse, N. Y.
Please send me the 12-page folder on Carrier Gas-fired Unit Heaters.

*Name*_____

*Firm Name*_____

*Address*_____

WHO'S WHAT *Continued*

▸ *SERVEL, INC.*—R. J. Arft, vice president and assistant to the president. Mr. Arft comes to Servel from Martin-Parry Corp, Toledo steel fabricators, where he was executive vice president, general manager and comptroller.

▸ *ARMSTRONG FURNACE CO.*—George Zimbelman, transferred to Columbus plant as assistant general manager; Charles L. Brooks, sales manager. Larry Hickock, executive vice president, is leaving Armstrong to devote his time to his own business holdings.

▸ *GUSTIN-BACON MFG. CO.*—F. W. Muller, manager of the insulation sales department; H. M. Grant and S. E. Brelsford, assistant managers of the department.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *YOUNG RADIATOR CO.*—John J. Sidwell, manager of new direct factory office at Chicago.

▸ *AMANA REFRIGERATION, INC.*—Alonzo N. Clark, manager of new Detroit sales region covering Michigan, northern Indiana, northwestern Ohio; James R. Gall, Buffalo regional sales manager covering upstate New York, western Pennsylvania, Ontario, Canada; Moto Radio Distributing Co., distributor for western Pennsylvania, northern West Virginia, southeast Ohio; Allied Appliance Co., representative for eastern Massachusetts, southern New Hampshire.

▸ *SCIAKY BROS., INC.*—New sales and service offices have been opened at Atlanta and San Diego.

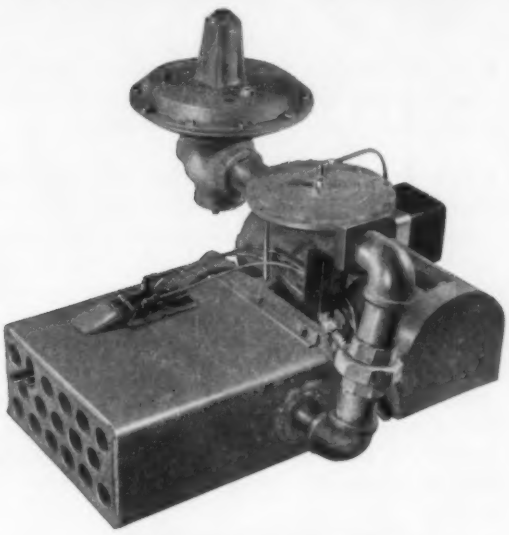
▸ *WHEELCO INSTRUMENTS DIV., BARBER-COLMAN CO.*—William Bohrer, appointed to the Cleveland office as sales engineer; Vincent Piedmonte, branch sales manager at Barber-Colman Ltd. of Canada in Toronto.

▸ *McQUAY, INC.*—Willard B. Buck, eastern regional manager.

▸ *ALL-STATE WELDING ALLOYS CO., INC.*—John H. Poulson, regional manager to cover New England, eastern New York State exclusive of the metropolitan area.

▸ *KINNEY MFG. DIV., NEW YORK AIR BRAKE CO.*—New sales engineers and their territories are: Arthur J. Shivers, Jr., Philadelphia; Jackson A. Brower, New York; Thomas A. Sowin, Chicago.

WHAT! NO STANDBY LOSS?



THAT'S RIGHT—

LO-BLAST

POWER-GAS BURNER

ELIMINATES THE FUEL WASTE CAUSED BY UNCONTROLLED DRAFT

When an atmospheric gas burner shuts off, the rush of draft air through the boiler or furnace carries heat with it up the chimney...causing a serious waste of fuel.

Since a burner is turned on and off several times an hour by the thermostat, a typical heating plant operates only about 2,000 hours of a 6,000 hour heating season. Hence, with an ordinary burner, "standby loss" occurs two-thirds of the time.

In contrast, the Lo-BLAST Power Gas Burner does not depend upon natural draft, but upon air supplied by a small, *quiet* blower. It provides combustion air *only when the burner is on!* When the burner shuts off, only enough air for pilot combustion is admitted. The heating plant retains much of its heat between operating cycles.

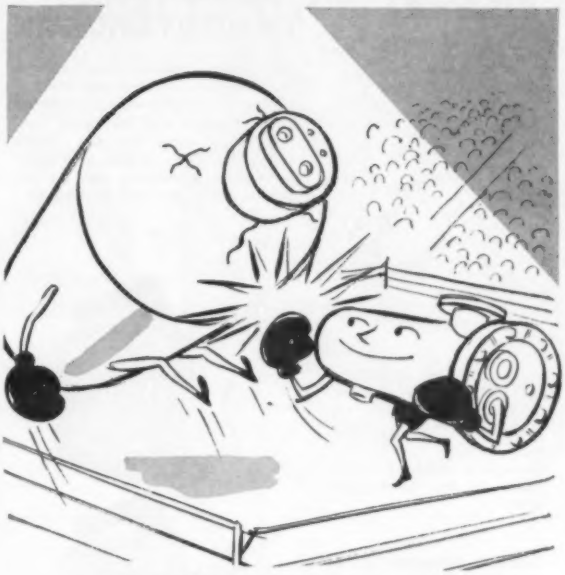
That's why Lo-BLAST Burners average 10% less in operating cost. Capacities of 75,000 to 20,000,000 BTU give complete coverage of residential, commercial and industrial fields.

Lo-BLAST ECONOMITE
The residential Lo-BLAST Burner—capacities 75,000—500,000 BTU.

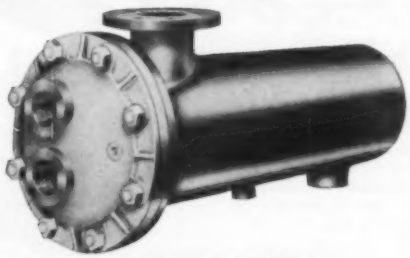
Send today for complete information on the Lo-BLAST Power Gas Burner

MID-CONTINENT METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

OUTCLASSED!



. . . by the really modern water-heating system . . .



the GENERAL Instantaneous Heater

Here's the compact, continuous water-heating unit that's knocking bulky storage systems right out of the picture! No wonder. Look at these advantages a GENERAL Instantaneous Heater gives you: 1. Easy, economical installation in a *fraction* of the space required for a bulky storage tank. Even installs overhead! Just tap into existing steam lines. 2. A new low in maintenance. Seamless copper tube, and bronze head and plate construction assure *lasting,* trouble-free performance. 3. Plenty of clean, hot water *as you need it.* Capacities up to 300 g.p.m. The ideal hot water source for industrial washrooms, cafeterias, laundries, dishwashing machines; as well as for apartment buildings. Write for full details. General Fittings Co., Box 151E, East Greenwich, R. I.

GENERAL FITTINGS COMPANY

INSTANTANEOUS WATER HEATERS AND HEAT EXCHANGERS

COMFORT HEATING
COMPLETELY AUTOMATIC

Unattended uniform heat around the clock . . . . and the cost of heating is sharply reduced with an Olson Heater. Let an Olson representative show you the "black and white" facts on how your plant or warehouse heating can be improved while the cost is reduced.

STAINLESS STEEL

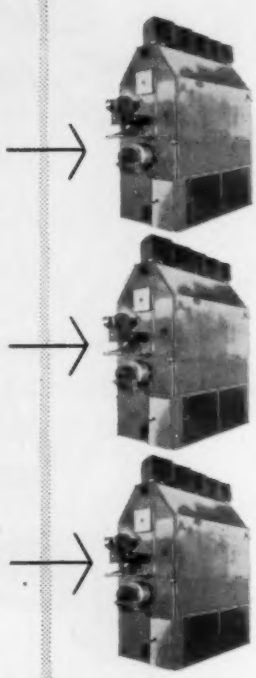
Combustion Chamber is constructed of AUSTENITIC STABILIZED stainless steel. It provides an effective gas travel pattern and reverse current through a band of boiler tubes in the economizer section.

RUGGED CONSTRUCTION

Built solid and tough, designed for easy maintenance. Free from vibration and quiet running. All important adjustments and controls are on the outside within easy sight and reach.

SEPARATE DRAFT FAN

An important feature that eliminates cold air blasts at every start — allows separate control between main blowing fans and exhaust.



Manufactured in a variety of sizes for gas, oil or dual gas and oil. The initial cost is low compared to complicated systems and there is nothing to freeze during extremely cold weather. Needs no attendant because it is completely automatic. The industrial styling is trim, neat and requires little floor space. After many years of service it's easy to disconnect and move to another location to be put back into service.

Other applications for the Olson S S are: make-up air, drying adaptations, high temperature and process work. Easily adapted to duct systems.

CAPACITIES
300,000
to
2,000,000
B.T.U. Output

GAS, OIL
OR DUAL
GAS & OIL

Olson

ARTHUR A. OLSON & COMPANY
CANFIELD, OHIO
Representatives in Principal Cities

WHO'S WHAT

Continued

▸ *PERFECTION INDUSTRIES, INC.*—Donald W. Milestone, manager of new western regional sales territory.

▸ *PENNSYLVANIA SALT MFG. CO.*—Alfred H. Pope, Cleveland area sales representative. He succeeds James Keers, recently transferred to Detroit.

▸ *JAS. P. MARSH CORP.*—New sales representatives and the territories they will cover are: Mansur Storrs, Maine, Vermont, New Hampshire, Connecticut, Rhode Island, Massachusetts; James G. Kelly, Colorado, Iowa, Nebraska, Wyoming; Thomas E. Zurick, Kentucky, West Virginia.

▸ *INTERNATIONAL NICKEL CO., INC.*—Headquarters of the central Atlantic coast technical field section have been relocated at 1150 York Rd., Abington, Pa., in the Philadelphia area. The section headquarters was in New York City prior to the move.

▸ *AUTOMATIC SWITCH CO.*—Pierre Lenmark Co., representative for solenoid valves and electromagnetic controls in Minnesota, the Dakotas, western Wisconsin; Joe E. Pearce and Assoc., electromagnetic controls sales representative for Arizona, New Mexico, parts of west Texas. Continental Sales and Engineering Co., Asco's Pittsburgh representative, has relocated to 211 Nelbon Ave. in that city.

▸ *AIRTHERM MFG. CO.*—Newly appointed sales representatives and their territories are: Noah M. Simmons Co., southern Indiana; Stringer and Spencer, southern New Jersey; Halberg Co., metropolitan New York; James F. McEntee, northern New Jersey; Mechanical Equipment Co., western Pennsylvania.

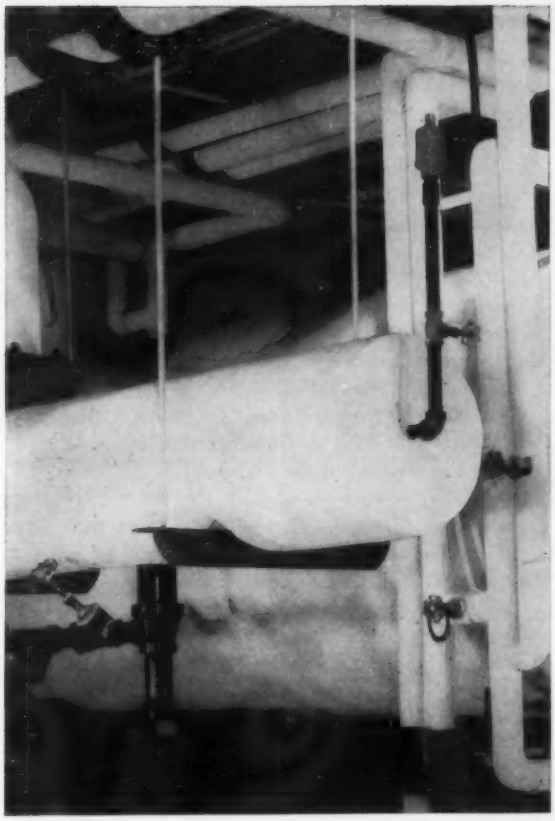
▸ *J. A. ZURN MFG. CO.*—Richard J. Benson and Richard O. Netschke of the Process Valve and Equipment Co., sales engineers in the Cleveland area for Zurn's industrial and marine divisions.

▸ *DELTA HEATING CORP.*—Carolina Sales Corp., distributor for eastern North and South Carolina.

▸ *IRON FIREMAN MFG. CO.*—Robert G. Duncan, district sales manager for western Massachusetts, Connecticut, Rhode Island.

▸ *JOHNSON SERVICE CO.*—San Francisco branch offices have been moved to 1129 Folsum St. from 739 Bryant St. in that city.

▸ *BRISTOL CO.*—Joseph H. Barry, socket screw sales representative in the Pittsburgh-Buffalo area.



THE FINISHING TOUCH TO A FINE INSTALLATION

A covering of insulation is what you see when you view any well-planned heating or cooling transmission line or unit.

The insulation must be wisely chosen, properly applied.

The fact that Sal-Mo pipe and boiler coverings are used exclusively, year after year, by many of the largest and most competent contractors is most natural and gratifying.

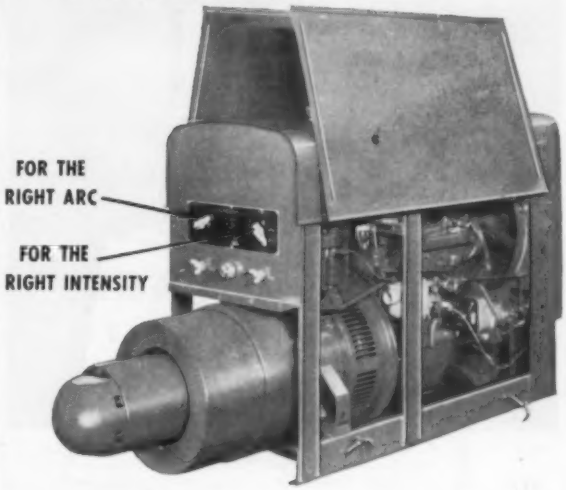
We invite you to join them. Catalogue which includes prices and packing schedules furnished on request.

Sal-Mo
ASBESTOS PRODUCTS

Made only by

SALL MOUNTAIN COMPANY
HAMILTON, OHIO

"SHIELD-ARC" SA-200 DUAL CONTROL



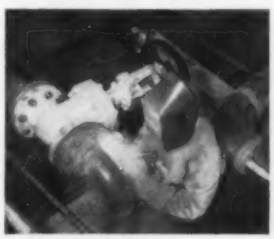
With Lincoln "Shield-Arc" you

PICK EXACT ARC to cut welding costs

HERE'S why more Lincoln SA-200 welders are in use today than any other engine-driven welders in the world:

FAST, SIMPLE DUAL CONTROL assures right type arc and right arc intensity for every job. This means that the operator can suit the arc to the job every time for flat, vertical or overhead welding.

COMPACT DESIGN provides long, dependable service, low-cost operation, highest quality welding.



Welding 6-inch flange *to elbow at the valve in refinery addition using "Shield-Arc" SA-200 with 5/32" "Fleetweld" electrodes.*

Welding 20 foot sections *of ice plant piping with "Shield-Arc" engine driven welder and 5/32" "Fleetweld 37" electrodes.*

SEE FOR YOURSELF. Compare "Shield-Arc's" money-saving features and low cost. Bulletin 1337, giving cost-cutting details, is available by writing on your letterhead.

THE LINCOLN ELECTRIC COMPANY
Dept. 3805 • CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

...this chemistry laboratory relies on long-lasting

TRANSITE INDUSTRIAL VENT PIPE

Here, in the chemistry laboratory of one of the nation's largest universities, Transite® Industrial Vent Pipe was specified for use in this fume hood installation because of its proven record of performance under severe conditions. It will provide long, trouble-free service without maintenance.

Made of two of nature's most indestructible minerals, asbestos and cement, Transite is highly resistant to the corrosive fumes, vapors and dusts that must so frequently be removed from research laboratories and industrial buildings. Whether installed indoors or outdoors, Transite never requires painting or other preservative coating.

Transite Industrial Vent Pipe offers other advantages, too. It is easy to install because it is light in weight and can be handled readily. No special equipment is needed for cutting on the job. A wide variety of fittings and pipe sizes make it adaptable to every industrial venting service.

For additional information about the use of Transite Industrial Vent Pipe for your venting problems, write to Johns-Manville, Box 60, New York 16, N.Y.

JOHNS-MANVILLE PRODUCTS

JOHNS-MANVILLE
TRANSITE INDUSTRIAL VENT PIPE
AN ASBESTOS-CEMENT PRODUCT

WHO'S WHAT

Continued

▸ *T. R. FINN & CO., INC.*—Edwin L. Keil, sales engineer in the New York City area; Allen, Mitchell & Co., agent for Maryland, District of Columbia, adjacent Virginia counties; George F. Bertrand Co., representative for southern New Jersey, eastern Pennsylvania.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—Charles J. O'Lone, manager of the Fielden Instruments Div.'s western regional sales engineering office at Lynwood, Calif. New sales engineers for the Heating Appliance Controls Div. are Milton G. Nichols at Dallas, to cover Texas, Oklahoma, Arkansas, Louisiana, and John R. Guenther at Chicago, to represent the division in the Midwest.

▸ *A. W. CASH CO.*—Representatives and their territories for automatic valves, controllers, governors, regulators are: David J. Rank Co., most of Kentucky, part of Indiana; Bert Gurney & Assoc., east Nebraska, west Iowa, part of South Dakota; Consolidated Engineering Sales Co., southwestern Ohio.

▸ *L.O.F. GLASS FIBERS CO.*—District sales managers and their territories are: Chester E. Shepperly, Boston; Ned P. Kimberly, Cleveland; Thomas D. Leathers, Pittsburgh; James J. Secor, Jr., Philadelphia; G. O. Hartzell, Toledo. George R. Frick is field representative in the Boston area, reporting to Mr. Shepperly.

▸ *COCHRANE CORP.*—George M. Wallace & Co., representative for water conditioning equipment, steam specialties, condensate return systems for the Rocky Mountain district; M. C. McKeown, manager of the Philadelphia district sales office.

▸ *C. A. DUNHAM CO.*—William J. Halpin, sales representative for the central New York territory.

▸ *TUBE TURNS PLASTICS, INC.*—Theron S. Bushnell, Midwest district manager with headquarters in Chicago.

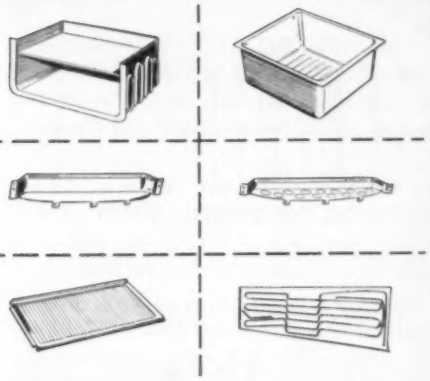
▸ *PHILADELPHIA GEAR WORKS*—J. Frank Ottinger, manager of new Baltimore district sales office to cover Maryland, District of Columbia, eastern Virginia; W. K. Kozel, Cleveland district sales office manager to cover midwestern Ohio.

▸ *COLEMAN CO., INC.*—Wilson C. Cartwright, manager of the branch office at Los Angeles; Lawrence R. Carney, regional sales manager for the Pacific Northwest and northern Rocky Mountain states; A. A. Courtney, national accounts sales manager, the post vacated by Mr. Cartwright. ∓

Many Parts and Accessories

are *BETTER* made of

FAIRMONT ALUMINUM

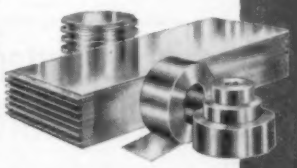


Refrigerator and freezer parts—pans, shelving, trays, evaporators, freezer liner panels—are increasingly being fabricated of Fairmont bright aluminum sheet to fulfill manufacturer's exacting requirements.

But there are other parts—too numerous to mention—that may now be better made of Fairmont aluminum, in improving appearance, high thermal conductivity, wear-resistant durability, and non-corrosive and stain-proof surfaces.

The use of Fairmont aluminum, increasingly available in a wide variety of grades and sizes, also may afford reduced labor and manufacturer's handling costs.

Fairmont bright aluminum rolling mill products—sheet, coil and circles are now available for prompt delivery to meet manufacturing schedules.



SALES OFFICES:

Baltimore, Buffalo, Chicago, Cleveland, Denver, Fairmont, Indianapolis, Jackson (Michigan), Los Angeles, Minneapolis, New York City, Philadelphia, St. Louis, Schenectady, Seattle.

FAIRMONT ALUMINUM COMPANY

•

Fairmont, West Virginia

Two NEW industrial heaters that mean MORE CONTRACTS for you

Easy to Install

Minimum Servicing

Automatic Operation

THERMOBLOC

DIRECT-FIRED HEATERS

The ideal warm air heater that heats large open buildings in all directions without ducts. Where necessary to heat individual rooms, THERMOBLOC is easily adaptable to ductwork.

THERMOBLOC is *fully* automatic and can be installed in a matter of hours. Available for either oil or gas, THERMOBLOCS are manufactured in nine models from 100,000 btu to 2,250,000 btu output. This means you can give your customers exactly what they need in heating capacity . . . fast!

Ask for Bulletin GC-4-55.

and "Bring the Sun Indoors" for your customers with...

PANELBLOC

GAS FIRED INFRA-RED UNIT HEATERS

Heats like the sun . . . with gentle, healthful rays. Requires no fan or motor . . . no electrical connections. Installation requires only support from ceiling and hooking up to fuel supply and vent. Unit burns any commercial type gas fuel. You can guarantee customers will keep warm even when power lines are down.

Infra-red rays radiate to the spot you want to heat. PANELBLOC heats only personnel and machines or other objects . . . not air.

Heat is not deflected by draft or wasted in the ceiling. No moving parts mean less maintenance. Available in two sizes, 62,500 btu and 125,000 btu input. Ask for Bulletin P-154.

You can please your customers and make more profits for your company by specifying THERMOBLOCS or PANELBLOCS, depending on the requirements of the installation. Contact Thermobloc Sales today.

THERMOBLOC

Division of

PRAT-DANIEL CORPORATION

5-10 Meadow St. • South Norwalk, Conn.

Prat-Daniel Corp.
5-10 Meadow St.
South Norwalk, Conn.

Gentlemen:

I would like to know more about ☐ THERMOBLOCS ☐ PANELBLOCS

Name_____ Title_____

Company_____

Address_____

WE HEAR THAT...

▸ *H. E. BOVAY, JR.*, consulting engineers, has moved to its own building at 5009 Caroline St., in Houston. The company has branches in Spokane, Wash. and Baton Rouge, La.

▸ *WALWORTH CO.* has acquired the assets and business of *ALLOY STEEL PRODUCTS CO., INC.* Under the terms of the transaction, Walworth will pay part common stock and part cash for the company. Alloy Steel has an indicated sales volume of over $4 million and employs 400 workers in plants at Linden and Bloomfield, N. J.

▸ *NORMAN E. BUETER*, Chicago engineering consultant, has announced his moving to the Madison Terminal Bldg., 9 S. Clinton St., in that city.

▸ A solar screening installation resulting in a net air conditioning savings of $13,300 has won top award in a national contest sponsored by *REFLECTAL CORP.* Submitted by *STEWART MFG. CO.*, Glendale, Calif., the winning entry effected a 72 ton reduction in initial air conditioning requirements.

▸ *BYRON JACKSON CO.* stockholders have overwhelmingly approved a reorganization plan calling for the merger of that company with *BORG-WARNER CORP.* The merger plan provides that Borg-Warner will exchange four shares of its common stock for each five shares of Byron Jackson.

▸ Ground has been broken at Pittsburgh to begin a $400,000 building program for centralized research operations of *DRAVO CORP.* The company announces that many types of applied industrial research will be carried on at the new facility. *ALEX W. DANN*, retired executive vice president and 42 year employee of Dravo, turned the first shovel of dirt.

▸ *IRON FIREMAN MFG. CO.* will construct a $900,000 manufacturing plant at Ligonier, Ind., with completion scheduled early in 1956. Present Iron Fireman plants are in Oregon, Ohio, and Canada.

▸ *VIKING INSTRUMENTS, INC.*, has acquired controlling interest in the *ECONO PRODUCTS CO., ALAN DAVIS*, president of Viking, has announced. Both companies are located in East Haddam, Conn.

▸ Construction has begun on *PITTSBURGH PLATE GLASS CO's* multi-million dollar glass research center. The center's two buildings, for development and product control and for basic research, will have virtually all glass exteriors, the company said.

TVC *Condensate Pumps*

LOW PRESSURE SYSTEM

LOW RETURN CONNECTION
LOW SPEED, LONG LIFE
CAST IRON RECEIVER
SINGLE OR DUPLEX

Specify the "Convertible" TVC in the 15 gallon receiver when ordering low pressure system condensate pumps.

Capacities from 500 to 10,000 sq. ft. E.D.R.

Available from Jobbers' Stock

A SINGLE UNIT easily converted at any time to a DUPLEX UNIT

The Single Unit TVC Condensate Pump in a 15 gallon receiver can be converted to a DUPLEX UNIT whenever load or other conditions require. Each receiver is furnished machined and drilled for the addition of another pump and control.

Conversion to a Duplex Unit doubles the capacity of the unit, or where desired, provides a stand-by pump. Additional pump is installed right on the job. Removal of the unit is unnecessary.

• Dimensions

15 gallon cast iron receiver for single or duplex units: diameter 25½", height of return above floor—7¾₆".
10 gallon cast iron receiver (for single units only): diameter 21", height of return above floor—6⅞".

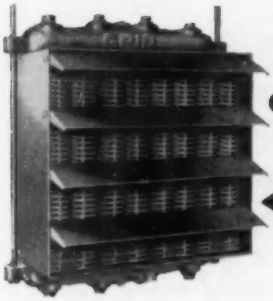
• Features

TVC Condensate Pumps are low speed (1750 RPM) for long life, are readily installed in area where space is important. Their compact cast iron receiver and sturdy pumping unit assure a trouble free installation.

• Installation

Simple installation consists of connecting return line to receiver, and connecting discharge to boiler, using a check valve and a gate valve. Unit is completely assembled at the factory. Send for Bulletin TVC300.

weil PUMP CO. 1514 N. FREMONT ST. • CHICAGO 22



hang 'em ...and forget 'em

GRID

UNIT HEATERS

Trouble-free heating service in the...

Nation's Leading Industries *since 1929*

...NO Maintenance or Repairs

The reason for this wide acceptance . . .

GRID'S All-Cast construction having similar metals in contact with steam prevents electrolytic corrosion.

GRID'S ability to withstand steam pressures up to 250# P.S.I.

GRID'S low outlet temperatures, proper fan sizes and motor speeds assure delivery of warm comfortable air in ample volume, directly to the spot where it is needed. Maintenance cost conscious management men turn to GRID for relief from the continuous expense of heating failures experienced with ordinary unit heaters. GRID Unit Heaters installed in 1929 are still operating today . . . the only attention needed has been an occasional oiling of the motor. No ordinary unit heater can approach this record.

- **STEEL MILLS**
  United States Steel
  Allegheny Ludlum
  Inland Steel
  Bethlehem Steel Corp.
  Carnegie Illinois Steel Co.
  Wheeling Steel Corp.
  Youngstown Sheet & Tube Co.
  Armco Steel Co.
  American Steel & Wire Co.
  American Chain & Cable
  Etc.
- **PAPER PRODUCTS**
  Marathon Corp.
  Everett Pulp & Paper Co.
  West Virginia Pulp & Paper Co.
  Consolidated Water Power & Paper Co.
  National Container
  Celotex Corp.
  Etc.
- **CHEMICAL PLANTS**
  E. I. Du Pont Chemical Co.
  Monsanto Chemical Co.
  Merck & Co., Inc.
  Allied Chemical & Dye Corp.
  Victor Chemical Works
  Dow Chemical Co.
  Etc.
- **RAILROADS**
  New York Central
  B & O R.R.
  Great Northern
  Canadian Pacific
  Santa Fe
  Chesapeake & Ohio
  Chicago North Western
  Pennsylvania
  Illinois Central
  Northern Pacific
  Milwaukee Road
  Etc.
- **AUTOMOTIVE**
  Electric Auto Lite Co.
  General Motors
  Ford
  Kelsey Hayes Wheel
  B. F. Goodrich
  U.S. Rubber Co.
  Goodyear
  Etc.
- **ELECTRICAL APPLIANCES**
  General Electric Co.
  Bendix Corp.
  Louis Allis Co.
- **FOOD PRODUCTS**
  Armour
  Swift
  General Foods Corp.
  Kraft Foods
  Beatrice Foods
  George A. Hormel Co.
  Borden Co.
  Penick & Ford
  Etc.
- **MISCELLANEOUS**
  Johns-Manville
  Minnesota Mining & Mfg Co.
  International Harvester
  Hercules Powder
  Falk Corporation
  Armstrong Cork
  National Lead Company
  Masonite
  Standard Oil Co.
  Sinclair Refining Co.
  Union Carbon & Carbide

Get the full story today. Ask for booklet CORROSION IN UNIT HEATERS . . . it's yours upon request.

D. J. MURRAY MANUFACTURING CO.

Manufacturers Since 1883 • WAUSAU, WISCONSIN

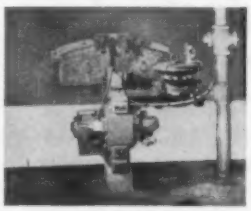
REPRESENTATIVES IN ALL PRINCIPAL CITIES

Why shop around?

Power-Flame HAS THEM ALL-

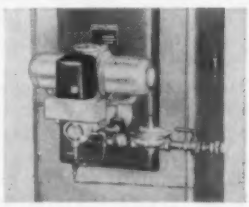
A BURNER UNIT TO FIT EVERY APPLICATION!

Regardless of application . . . commercial, industrial or domestic . . . there's a POWER-FLAME BURNER engineered to give *superior performance more economically*



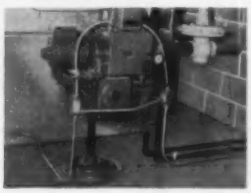
A box manufacturer in Pittsburg required continuous low cost steam. Of course he chose this compact Power-Flame Burner.

BFG Series—Outstanding in the industry, with these advanced features: factory wired-controls and valves mounted . . . wired sequencing panel provides purge period for utmost safety . . . positive control of air for combustion. 8 easy-to-install models in capacities from 450,000 BTU to 9,000,000 BTU input. Large capacities for heating or power processing.



Another example of an oil fired furnace converted to gas with Power-Flame.

FG Series—POWER-FLAME'S answer to the homeowner. An inexpensive replacement of oil burner for the small or large home or small industrial application. 3 gun type units . . . Model FG 175 capacity to 175,000 BTU, AGA listed; Model FG 330, capacity to 330,000 BTU, AGA listed; Model FG 500, capacity to 500,000.



A single compact unit firing both gas and oil. A clothing store in Missouri elected the Power-Flame FGO 3500 for uninterrupted heating service.

FGO Series—POWER COMBI-MATIC gas-oil—6 models—for gas and light oil in capacities to 3,500,000 BTU input. Features include . . . automatic ignition for both fuels . . . automatic air adjustment . . . electronic safeguard . . . factory assembled and tested for both gas and oil. Automatic or manual changeover optional.

A Power-Flame Dealership can be valuable; write today for complete information

Power-Flame BURNER

A Division of

Siemon Manufacturing Company • Grandview, Mo.

Savings from only 2 Paid for All 85

Astounding but true!

Read the facts on

Walker

"BB" Industrial Draft Controls

In the Fairmac Corporation Housing Development near Washington, D.C., replacement of existing "controls" with Walker "BB" Draft Regulators reduced fuel consumption in two boiler houses to such an extent that the cash savings actually paid for complete installation of all 85 Walker draft units! These fuel savings were accomplished in only *three months time*—and they were so spectacular that the April, 1953 issue of *Fueloil & Oilheat* devoted its lead article to a report of the complete details of the story! Reprints of this article are available upon request.

Walker "BB" Industrial Draft Controls can bring you the same kind of savings that the Fairmac Corporation is enjoying. Find out how by reading Walker's "Handbook of Draft Control for Industrial Installations." It gives the most complete facts ever assembled on control selection, proper location, capacities, installation and adjustment. This valuable handbook is absolutely free — and your request for a copy puts you under no obligation. Reserve your copy now—just send coupon below to:

Walker
MANUFACTURING & SALES CO.
1720 Penn St., St. Joseph, Mo.

Gentlemen: I want the complete story on how Walker "BB" Industrial Draft Controls can cut my fuel costs. Please send me your free handbook on "Draft Control for Industrial Installations." I'm considering draft control installations on:

Name.....

Company.....

Address.....

State.....

Office Building ☐
School ☐
Apartment ☐
Theater ☐
Store ☐
Factory ☐
Laundry ☐
Garage ☐
Other _____

WE HEAR THAT *Continued*

▸ *REYNOLDS METALS CO.* started construction recently on the outskirts of Richmond, Va. on an aluminum building to house its executive offices. The completed cost of the entire project, including property and landscaping, will be about $10 million. Completion is scheduled for mid-1957.

▸ *TRION, INC.* has sold all rights to its "Dill Dust-Spot Tester" to the *RESEARCH APPLIANCE CO.* The instrument is designed for measuring the efficiency of all types of air filters installed in ventilating systems. Trion believes that such an instrument should be manufactured and sold by a disinterested company, not one associated with the air cleaning field.

▸ Contracts have been let for *WHEELING CORRUGATING CO.'s* half million dollar warehouse and office building in Minneapolis. The building, to cover an area of approximately 220 by 240 ft, will be completed about April, 1956. Many of the company's products will be used in constructing the warehouse.

▸ The *L.O.F. GLASS FIBERS CO.* has awarded a contract for construction of a 100,000 sq ft plant—the company's second in the Defiance, Ohio, area. The main structure will be used largely for storing insulation products made at the other Defiance plant.

▸ *WOLVERINE TUBE's* Long Island mill depot has been moved to larger quarters at 42-02 11th St., Long Island City, N. Y., *G. H. TOBELMAN*, eastern district sales manager, has announced.

▸ *JOHN J. LANDERS*, president of the *LANDERS ENGINEERING CO.*, Buffalo, announced that the firm was renamed the *LANDERS EQUIPMENT CO., INC.*, as of Sept. 1.

▸ A contract to build a 10,000 sq ft warehouse in Harrison, N. J., has been awarded by the *NATIONAL-U.S. RADIATOR CORP.* to the *LURIA ENGINEERING CO.* of Bethlehem, Pa. The column-free interior and rigid frame construction will provide maximum storage space.

▸ *JACUZZI BROS., INC.* has announced the opening of its Dallas factory branch, which will be the firm's operating headquarters for the Southwest. The new plant will be managed by *UGO JACUZZI*, son of one of the original Jacuzzi brothers.

▸ *PENN CONTROLS, INC.*, recently held a four day sales conference at the company's main office and factory. Personnel from throughout the United States and Canada discussed markets, technical developments, and customer service.

get the inside story

on your **AIR FILTERS**

at a glance!

HAYS AIR FILTER GAGES

With an air filter gage you measure the resistance that air meets in passing through a filter—you get the *inside story* at a glance.

A dirt-clogged filter in air circulating or air conditioning systems lowers efficiency and costs you money. Needless changing of filters to avoid clogging is expensive. A small investment in a Hays air filter gage removes this guesswork . . . results in real savings.

Models and mountings available for every air filter use—features include:

- ***easy to read***—**the large dial is visible from a distance.**
- ***minimum maintenance***—**there is no oil to evaporate and no leveling is required.**
- ***constant accuracy*** — **Hays' special "slack diaphragm" retains accuracy.**
- ***easy zero check***—**external zero adjusting screw provided.**

Gages can be furnished with contacts for flash or sound alarms or with damper controls. Portable models also available.

For complete details on Hays Air Filter Gages, write for Bulletin 54-751-12.

THE **hays** CORPORATION

Michigan City 14, Indiana

Automatic Combustion Control
Boiler Panels • CO_2 Recorders
Variflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

only gas unit heating offers *all* these advantages

- **COMPLETE ADAPTABILITY TO FUTURE CONSTRUCTION** — internal remodeling or added space can easily be accomodated by merely shifting or adding a few units.
- **EASE OF INSTALLATION** — no ducts, no complicated piping, no radiators or registers to fool with. Gas unit heaters can be installed in an existing structure as easily as in a new building.
- **INSTANT RESPONSE TO EVERY CHANGE IN TEMPERATURE** — heat produced on the spot in a matter of seconds after the control system calls for it.
- **LOW INITIAL COST** because the cost of the heater is the entire equipment cost — no piping or ducts, radiators or registers to buy.
- **SAVING ON VALUABLE FLOOR SPACE** — suspended units occupy no space which could be used for any other purpose.
- **EXTRA HEAT FOR TROUBLE SPOTS** such as areas facing large doors.

FOR HEATING

- STORES
- FACTORIES
- WAREHOUSES
- RESTAURANTS
- SCHOOLS
- SHOWROOMS
- PUBLIC BUILDINGS
- AND MANY OTHERS

and here's why Reznor is by far the world's largest-selling gas unit heater

One out of every two gas unit heaters sold today is a Reznor. There are two reasons for this domination: "years-ahead" engineering and quality workmanship. An alert, aggressive product development program keeps Reznor ahead of the field in the introduction of improvements for greater heating efficiency, economy and comfort. High standards of craftsmanship and the use of only the finest materials and components insures for Reznor customers the full benefit of this engineering leadership.

Mail the coupon below for your copy of the new Reznor catalog and other helpful information on Reznor gas unit heating. DO IT TODAY

REZNOR
THE WORLD'S LARGEST-SELLING GAS UNIT **HEATERS**

Reznor Manufacturing Co. • 51 Union Street • Mercer, Pa.

Please send me my free copy of your new catalog and other material on Reznor gas unit heating.

NAME..... TITLE.....

COMPANY.....

STREET.....

CITY..... ZONE..... STATE.....

WE HEAR THAT

Continued

▸ *DRAVO CORP.* will supply heating equipment for *FORD MOTOR CO.'s* new automotive proving ground north of Detroit. The heaters will be used for the comfort heating and ventilation of the headquarters which will house offices, maintenance and storage garages and a cafeteria.

▸ *PULLMAN VACUUM CLEANER CORP.* has announced moving to a larger plant at 25 Buick St., Boston. Pullman's new home is a reinforced concrete building with over 40,000 sq ft of space.

▸ *CARRIER CORP.* has taken an option on a 68 acre tract of land near Los Angeles, *LYLE C. HARVEY*, senior vice president, has announced. The company needs more facilities for the *DAY & NIGHT* and *PAYNE DIVS.* now at Monrovia, Cal., Mr. Harvey added.

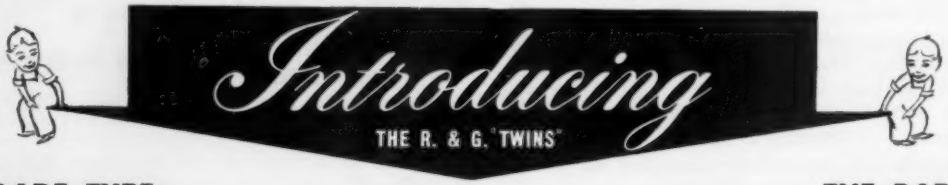
▸ The *QUICKDRAFT COMPANY* has announced that general offices and manufacturing facilities, formerly located in Hamilton, Ohio, have been moved to Canton, Ohio. General offices and all production facilities have been integrated with *QIUCKDRAFT ENGINEERING* of Canton. The company's mailing address is Dueber-Hampden Building, P.O. Box 87, Canton 1.

▸ *BELL & GOSSETT CO.* recently completed the first in a series of three day regional educational meetings for the sales staff. Additional meetings, this year, will be held in Philadelphia, Atlanta, and Salt Lake City.

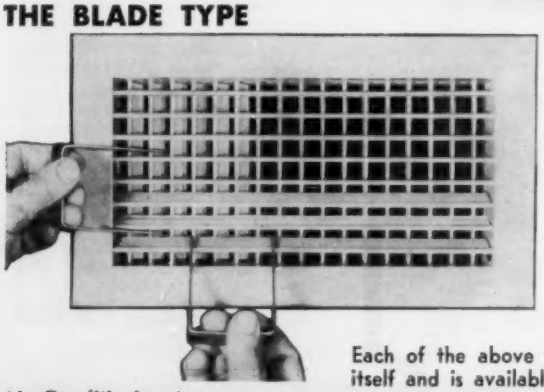
▸ *DESOMATIC PRODUCTS, INC.* has extended its Falls Church, Va. plant facilities for the manufacture of moisture control equipment. The manufacturing area is now over 15,000 sq ft and has nearly 50 employees. The expansion will provide for shipments in excess of $1 million per year, the company reports.

▸ *NOVELTY STEAM BOILER WORKS, INC.*, a subsidiary of the *ELLICOTT MACHINE CORP.*, has completed installation of a new department to be devoted to the application of tank linings. The facility will afford the purchaser the opportunity of securing tank and lining at the same source, the company reports.

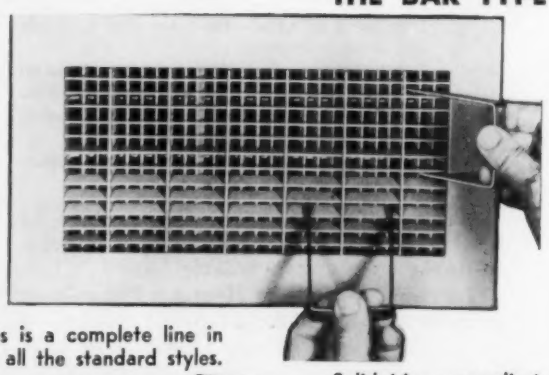
▸ *AMANA REFRIGERATION, INC.* has offered to repair, clean and place in good operating condition any of its freezers or air conditioners damaged by hurricane Diane or by the floods that followed. All repairs will be done at no cost to the owner. The offer was made to aid in the relief of victims of the battering storm that lashed the East Coast recently. ⧺



THE BLADE TYPE



THE BAR TYPE



Each of the above types is a complete line in itself and is available in all the standard styles.

Air Conditioning type Registers and Grilles for the maximum in directional and volume control — Noiseless Operation — Strength and Beauty. Registers equipped with tamperproof opposed blade action, key operated shutters.

For QUALITY, STRENGTH, and DEPENDABILITY
In SCHOOLS
In HOSPITALS
In PUBLIC BUILDINGS Dept. B

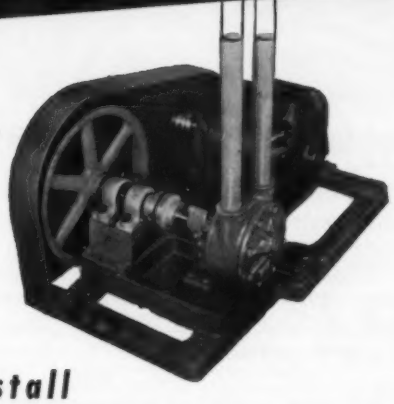
FREE Catalog On Request

Two Complete Lines of Registers and Grilles for HEATING • VENTILATING • AIR CONDITIONING

REGISTER & GRILLE MFG. CO., INC.
70 BERRY STREET, BROOKLYN 11, N. Y.

Solid 14 gauge adjustable bars make this style rugged and long lasting. Interlocking construction makes them tamperproof, adjustable only with the special tool provided.

HOW TO GET
FUEL PUMP PERFORMANCE
THAT CUTS MAINTENANCE COSTS



Install
TUTHILL TYPE SU *Pumping Units*
For Dependable Service
in Industrial Heating

Tuthill Type SU multiple V-belt pumping units provide structural and performance advantages for dependable, uninterrupted operation that add up to reduced maintenance expense.

Features like these make the SU outstanding for handling heavy fuel oils in industrial heating:

- ★ **Motors up to 5 h.p. mounted on slotted slide rails for easy adjustment or replacement. No drilling or tapping required.**
- ★ **Cast iron base with mounting bolts and adjustments easily accessible.**
- ★ **One-point belt-tension adjustment.**
- ★ **Jack shaft, supported by ball-bearing pillow blocks, carries entire weight of pulley and absorbs belt tension.**
- ★ **Pump, jack shaft and pillow blocks available as separate unit.**
- ★ **Pump and jack shaft direct-connected by flexible coupling for better alignment and simplified mounting.**
- ★ **Wide range of pump models and capacities.**

Complete data is presented in Tuthill Catalog No. 107. Write for your copy today.

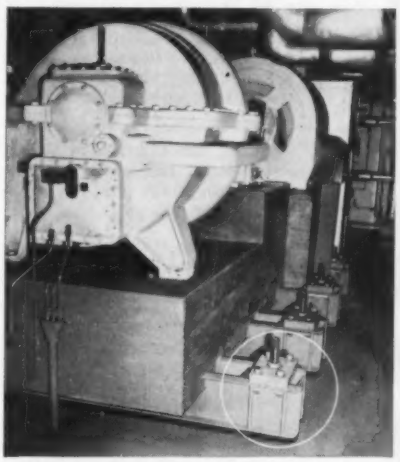
TUTHILL
PUMPS FOR THE PURPOSE

TUTHILL PUMP COMPANY
Dependable Pumps since 1927
939 East 95th St., Chicago 19, Illinois
Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

In this "Drive-In" Office Building

KORFUND VIBRATION CONTROL *allows more rentable space*

A feature of the Cafritz Building in Washington, D. C., makes it possible to drive your car up a series of ramps, and park it outside your office door.



The Cafritz Building, Washington, D. C.
LeRoy L. Weiner *Architect*
William A. Brown *Consulting Engineer*
Cafritz Construction Company *Builder*
Mehring & Hanson Company *Mechanical Contractors*

Another feature is this 530 Ton Centrifugal Refrigeration Machine installed on the roof. Korfund Steel Spring Vibro-Isolators with adjustable leveling bolts (a Korfund feature for over 30 years) made this installation possible, since they completely prevent vibration and noise transmission even to floors directly below. This makes available more revenue producing space elsewhere in the building.

This is just one of hundreds of successful upper floor installations of heavy air conditioning equipment on Korfund spring isolators. Only Korfund Vibro-Isolators allow really heavy upper floor installations without floor reinforcement and with positive assurance of vibration and noise control.

Utilize all possible revenue producing space — move air conditioning equipment upstairs. Korfund experience makes it possible. There is no substitute for experience.

For more information, write for your copy of Bulletin 23, or see our catalog in Sweet's Files.

For specific recommendations, contact us or your local Korfund Office. Look under "Korfund" in your local Telephone Directory or Thomas' Register. A half-century of experience is at your disposal.

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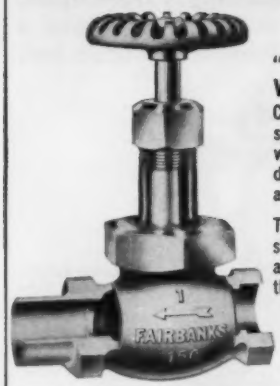
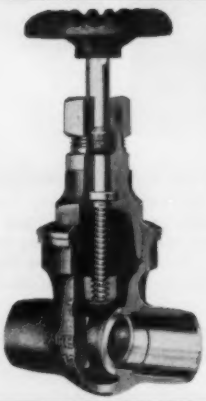
insure permanent leakproof joints in copper or brass piping

Fairbanks THREADLESS Valves



"Fairco-Braze" Threadless Valves for silver brazed joints. Cut costs, speed installation of piping systems handling steam, hot or cold water, oil, compressed air, carbon dioxide, Freon and many other liquids and gases.

The silver brazed connection withstands tension, compression, torsion and vibration to a far greater degree than any other type joint.



Solder End Threadless Valves for soldered joints. Get perfect seal of valves for type "K", "L" and "M" copper tubing with Fairbanks Solder End Threadless Valves. Simple, quick installation provides a smooth, compact, full flow assembly that has high resistance to corrosion.

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MEETINGS & CONVENTIONS

OCT. 17-19—*American Gas Association and Pacific Coast Gas Association*, 1955 convention. Statler Hotel, Los Angeles. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 17-21—*American Welding Society*, national fall meeting. Bellevue-Stratford Hotel, Philadelphia. AWS headquarters: 33 W. 39th St., New York 18.

OCT. 17-21—43rd *National Safety Congress and Exposition*. Conrad Hilton, Congress, Morrison and LaSalle Hotels, Chicago. Information: R.L. Forney, general secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11.

OCT. 18-21—*National Association of Corrosion Engineers*, 1955 South Central region meeting. Hilton-Shamrock Hotel, Houston. NACE headquarters: 1061 M & M Bldg., Houston 2.

OCT. 19-21—*AIME-ASME Joint Solid Fuels Conference*. Neil House, Columbus, Ohio. Cosponsored by the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers. The latter is located at 29 W. 39th St., New York 18.

OCT. 20-21—*Sixth Annual National Noise Abatement Symposium*. Armour Research Foundation of Illinois Institute of Technology, Chicago. The Foundation is at 35 W. 33rd St., Chicago 16.

OCT. 20-*NOV.* 3—*International Atomic Energy Exhibit*. Carnegie Endowment International Center, on United Nations Plaza, New York. Open free to the general public. Sponsored by Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16.

OCT. 24-26—*American Standards Association*, annual meeting. Sheraton Park Hotel, Washington, D. C. ASA headquarters: 70 E. 45th St., New York 17.

OCT. 27-28—*National Conference on Industrial Hydraulics*, 11th annual meeting. La Salle Hotel, Chicago. Sponsored by Illinois Institute of Technology and Armour Research Foundation, 35 W. 33rd St., Chicago 16.

NOV. 1-5—*World Symposium on Applied Solar Energy*. Westward Ho Hotel, Phoenix. Subjects to be discussed are space heating and cooling with solar energy, solar water heaters, mechanical energy from solar energy, direct conversion of solar energy and others. Symposium is cosponsored by the Association for Applied Solar Energy and Stanford Research Institute, Stanford, Calif.

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It can be used in any space heating control circuit in any type of building where lowered night or week-end temperatures are desired.

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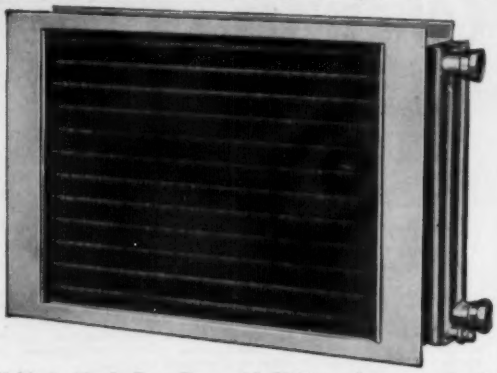

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MEETINGS & CONVENTIONS

Continued

NOV. 14-17—*2nd International Automation Exposition.* Navy Pier, Chicago. Exposition headquarters is at 845 Ridge Ave., Pittsburgh 12.

NOV. 14-18—*Chicago Exposition of Power & Mechanical Engineering.* Coliseum, Chicago. The exposition is being held in conjunction with the 75th Anniversary Meeting of the American Society of Mechanical Engineers, November 13-18, at the Congress, Conrad Hilton and Sheraton-Blackstone Hotels in that city. Management: International Exposition Co., Inc., 480 Lexington Ave., New York 17.

NOV. 16-17—*Industrial Hygiene Foundation,* 20th annual meeting. Mellon Institute, Pittsburgh. The Foundation is at Mellon Institute, 4400 Fifth Ave., Pittsburgh 13.

NOV. 27-29—*National Heating and Air Conditioning Wholesalers, Inc.,* national convention. Governor Clinton Hotel, New York. NHAW headquarters: 1200 W. Fifth Ave., Columbus 12, Ohio.

NOV. 28-*DEC.* 1—*9th Exposition of the Air Conditioning and Refrigeration Industry.* Auditorium, Atlantic City. The exposition is sponsored by the Air Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington, D. C.

NOV. 30-*DEC.* 1—*National Warm Air Heating and Air Conditioning Association,* 42nd annual convention. Hotel Statler, New York. The Association is at 640 Engineers Bldg., Cleveland 14.

DEC. 1-3—*American Society of Refrigerating Engineers,* 51st annual meeting. Traymore Hotel, Atlantic City. R. C. Cross, secretary, 234 Fifth Ave., New York.

Dec. 5-9—*25th Exposition of Chemical Industries.* Commercial Museum and Convention Hall, Philadelphia. Management: International Exposition Co., 480 Lexington Ave., New York 17.

DEC. 10-17—*Nuclear Congress and Atomic Exposition.* Municipal Auditorium, Cleveland. American Institute of Chemical Engineers is the sponsor. Exposition director: Athel F. Denham, Atomic Exposition. 931 Book Bldg., Detroit 26. Concurrently will be held the *Nuclear Engineering and Science Congress,* December 12-16. Engineers Joint Council, 29 W. 39th St., New York 18.

JAN. 23-25—*American Society of Heating and Air-Conditioning Engineers, Inc.,* annual meeting. Sheraton-Gibson Hotel, Cincinnati. ASHAE headquarters: 62 Worth St., New York 13.

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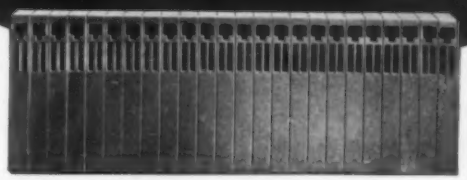

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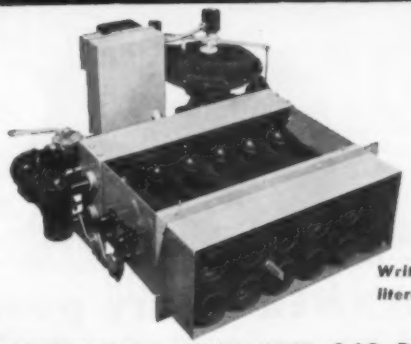

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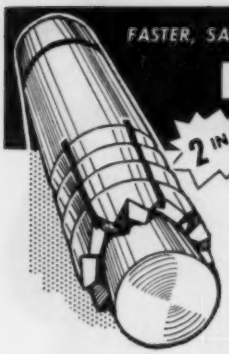

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MEETINGS & CONVENTIONS

Continued

JAN. 23-26—*7th National Plant Maintenance & Engineering Show.* Convention Hall, Philadelphia. Management: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

FEB. 7-9—*11th Annual SPI Reinforced Plastics Division Conference.* Chalfonte-Haddon Hall, Atlantic City. Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36.

MARCH 21-23—*18th Annual American Power Conference.* Hotel Sherman, Chicago. Sponsored by Illinois Institute of Technology, 35 W. 33rd St., Chicago 16.

JUNE 18-20—*American Society of Heating and Air-Conditioning Engineers, Inc.,* semi-annual meeting. Shoreham Hotel, Washington, D.C. ASHAE headquarters: 62 Worth St., New York 13.

FEB. 25-*MAR.* 1, 1957—*International Heating & Air-Conditioning Exposition.* International Ampitheater, Chicago. Under auspices of the American Society of Heating and Air-Conditioning Engineers. Management: International Exposition Co., 480 Lexington Ave., New York 17. ⧺

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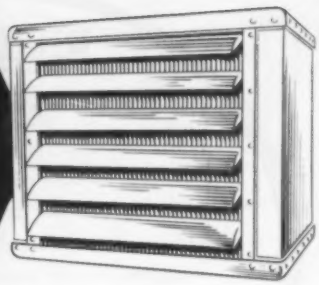

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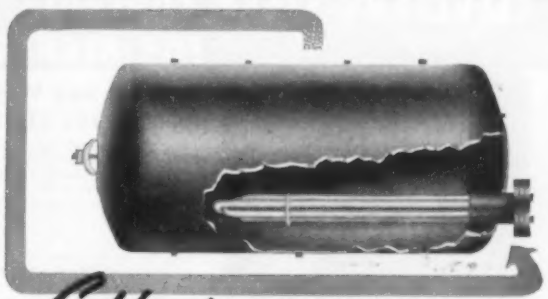

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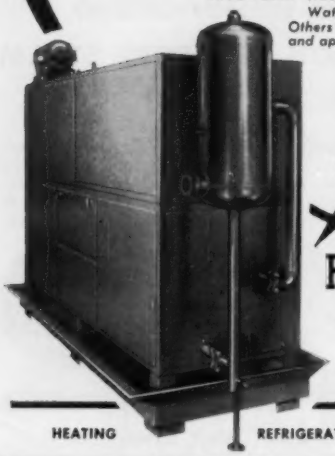

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A Study of the Blackness Test as a Means of Assessing the Performance of Air-Cleaning Plant —By H. E. Rose. A 10 page article in the July 1955 issue of the Journal of the Institution of Heating and Ventilating Engineers, 49 Cadogan Sq., London, S.W.I., England.

ARI Standard for Room Air Conditioners—Revised Ed. Copies from Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W. Washington 6, D.C. 35c.

Applications of Meteorological Data to Indoor Climate in Buildings—By George V. Parmelee. A nine page article in the June 1955 issue of the Bulletin of the American Meteorological Society, 3 Joy St., Boston 8.

Tentative Specifications for Cork Board Thermal Insulation—ASTM designation: C 352—54 T. American Society for Testing Materials, 1916 Race St., Philadelphia 3. 30c. ⧺

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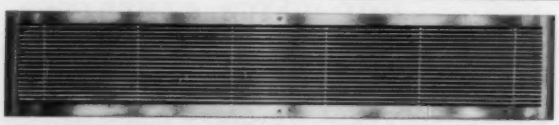

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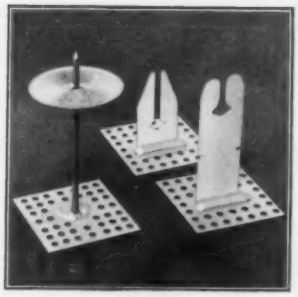

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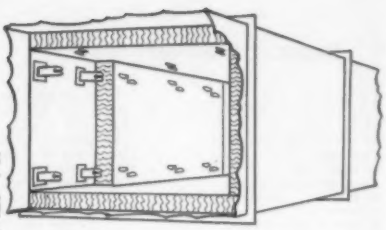

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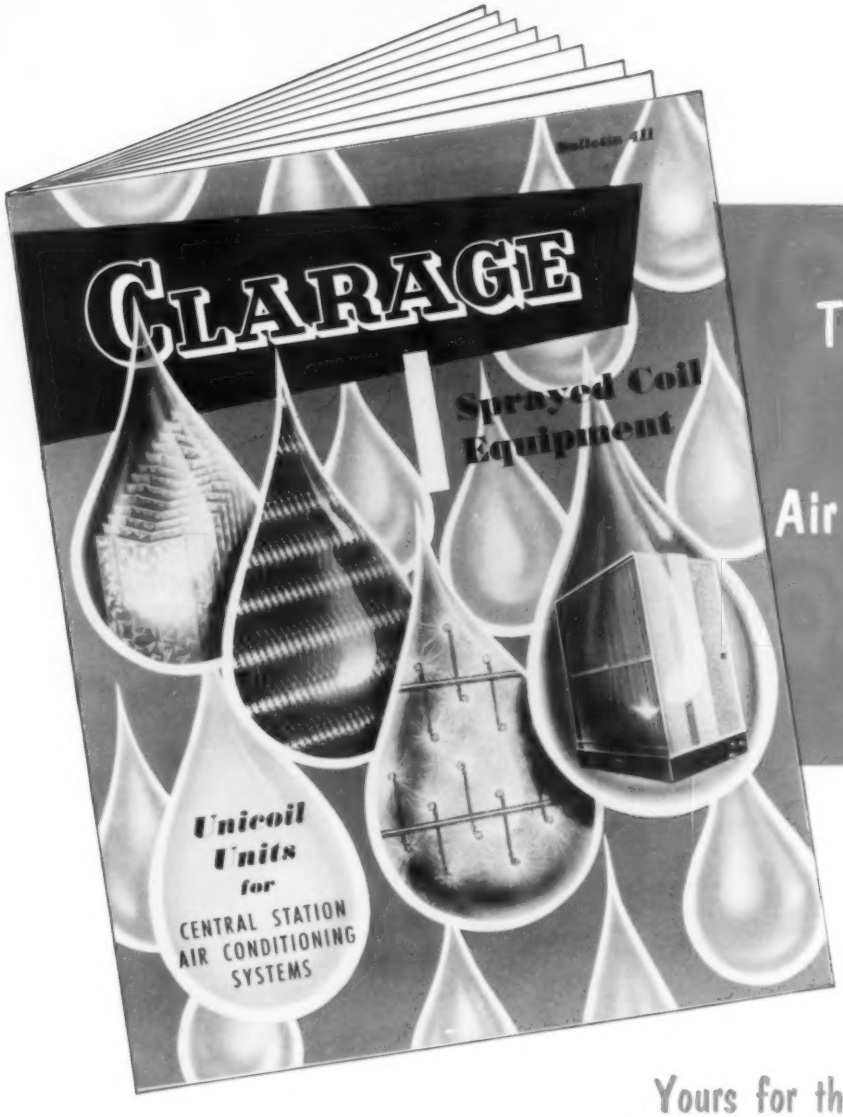

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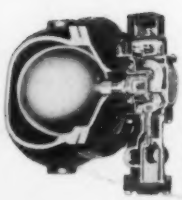

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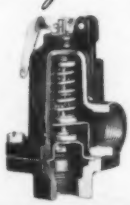

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